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*Illustrated.

THE cause of the rear collision on the New York, New Haven & Hartford is discussed elsewhere in this issue. There is, however, a question raised by the discussion, especially in the more sensational daily papers, of one phase of this collision which is deserving of the most serious consideration by higher railroad officers. It is one of purely public relations of the railroads. The routine on the New Haven, and probably on a good many other roads, provides for the destruction of the debris of a wreck immediately after such debris has been cleared from the track. Many of the traveling public are probably not unfamiliar with the sight of smashed freight cars being burned near the site of a recent wreck, and, in itself, of course, the fact that the remains of the wooden parlor car Skylark were burned shortly after the debris had been removed from the New Haven tracks at Stamford is of no importance one way or the other. The short-sightedness of the management in permitting the ordinary routine to be carried out in this particular case seems almost inconceivable. Every responsible railroad officer might be absolutely satisfied in his own mind that the wooden Skylark was no different in construction, design, capability of resisting shock, etc., from any other wooden parlor car built about the same time, but every intelligent, responsible railroad officer ought by this time to have learned that he cannot manage his own business in his own way regardless of the effect it may have on an easily aroused public sentiment. A man must be lacking indeed in yellow news sense who could not see the possibilities of red headlines, 2½ in. high, proclaiming "Mellen Orders the Wooden Skylark Burned." What if the New Haven management is lending every facility to the various and numerous investigations that have been begun to inquire into every detail of the fatal New Haven collision? The officers of the road are no doubt correct in declaring that the preservation of the debris of the Skylark would not have helped the scientific investigation of the circumstances surrounding the collision in the very slightest degree, but this can no more serve as an adequate excuse for what must appear as an utter blunder than would any other academic argument which omitted to take into consideration human nature.

THE letter printed elsewhere states in a quite clear manner one very common misconception as to the possibility of the government regulation of the issue of railroad securities. It is a misconception, however, which is not confined to our correspondent, but has been made manifest in various state laws and has even appeared in the writings of students of the railroad question whose views carry a good deal of weight. Our correspondent suggests that a law be passed prohibiting railways from issuing bonds except to the extent of 90 per cent. of their stock. By this he can only mean one thing, that railroads shall be prohibited from issuing bonds except to the extent of 90 per cent. of the *par value* of their stock. The Chicago, Milwaukee & Puget Sound was organized in a state which permitted the sale of bonds only to the extent of 50 per cent. of the issue of stock. When the Puget Sound, therefore, desired to issue $100,000,000 of bonds, it was compelled to first authorize and issue $200,000,000 of stock. The issue of this stock did not add one cent of equity behind the bonds, nor could any law be passed which would compel investors to buy this $200,000,000 of stock. The only possible way in which the bondholders' equity in a railroad property can be strengthened is from the voluntary purchase by investors of stock, and the only way that railroad stock can be sold is through making an attractive enough offer to investors to induce them to buy stock. The only reason why an investor should make a purchase of railroad stock is with the hope of making a profit on his investment. If we increase the profit we increase the attractiveness of stock as compared with bonds. In a way, our correspondent's letter is an unconscious appeal for higher railroad rates in so far as it is a recognition of the need of a greater margin of safety.

THE exchange of about $38,000,000 Southern Pacific stock for the stock of the Baltimore & Ohio held by the Pennsylvania Railroad represents probably not so much the hope that either the Union Pacific or the Pennsylvania Railroad will benefit materially from any change that might be brought about in traffic conditions, as it does one of the desperate efforts which the Union Pacific directors are being forced into by the attitude of the Attorney General in regard to carrying out the orders of the Supreme Court. There never has been, in the literal sense of the word, a transcontinental railroad system in the United States. Before Mr. Harriman's death, he was a director in the Baltimore & Ohio, and unquestionably a very influential member of the board. He was also director in the New York Central, and would, presumably, if he had lived, become an influential member of that board. The transfer of a considerable block of Baltimore & Ohio stock from the Pennsylvania Railroad to the Union Pacific will not probably in practice greatly change the present traffic relations either of the Baltimore & Ohio or of the Union Pacific. From an entirely theoretical point of view, it would be hard to conceive of any move which would more thoroughly carry out the intent of the Sherman law as it was interpreted by the former administration at Washington when it brought the Harriman Lines' dissolution suit than this exchange of Southern Pacific for Baltimore & Ohio. If it were true that any considerable portion of the freight traffic originating at the eastern seaboard for movement over the Baltimore & Ohio and Pennsylvania Railroad was destined for the Pacific coast, and could be given at the will of the originating railroad to either the Union Pacific or Southern Pacific, or that any considerable traffic originating in California could in the same way be delivered to either the Pennsylvania or the Baltimore & Ohio for carriage to the Atlantic coast states, the alliance between the Pennsylvania and the Southern Pacific on one hand and the Baltimore & Ohio and the Union Pacific on the other hand would open a way for the keenest sort of competition. As a matter of fact, however, the proportion of traffic coming under this category is so inconsiderable, the free choice of routing off its own lines by the originating carrier so slight, and the give-and-take relations between eastern trunk lines and so-called transcontinentals so complicated and delicate that such potential competition is hardly likely to ever become an important factor either in the rate situation or in the routing of traffic.

ONE of the most arbitrary of all the arbitrary things done by the Post Office department during the past dozen years, in its efforts to reduce the compensation paid to the railroads, when Congress has refused to authorize reductions, was the issuance of the orders of March 2 and June 7, 1907, to include Sundays in the days counted to ascertain the average daily weight of mails carried. Those orders have now been declared by the Court of Claims unlawful, in a decision which is reported in another column and which, it is estimated, will take $20,000,000 out of the government treasury. The decision will be found interesting reading. Congress had not merely neglected to act in the matter; it had considered the question of changing the divisor from 6 to 7, and had definitely rejected the proposition. Moreover, the use of the higher divisor puts a premium on inefficiency, as it tends to induce the railroad to carry no mails on Sunday. The court says "The injustice of using 35 as a divisor for the seven-day roads is easily illustrated: Suppose there are two lines or roads the same length and carrying the same amount of mail (say 30 tons a month). One carries these mails six days a week, excluding Sundays, and the other within the full seven days. The Post Office department weighs these mails for a period embracing 30 successive working days for both these lines, which must necessarily be for five weeks, or 35 days, if it weighs the Sunday mails, in order to cover 30 successive working days for the six-day road, and thus would obtain an aggregate of 30 tons for each road. It divides this aggregate sum by 30 for the six-day road, as that was the number of successive working days the mails were weighed for that road, and obtains the correct average of 1 ton per day for that road; it divides the same aggregate by 35 for the seven-day road, as that was the number of days the mails were weighed for that road, and gets a daily average only of six-sevenths of a ton, which allows the latter road no pay whatever for carrying the Sunday mails." And for a road carrying no mails on Sunday the injustice of the seven-day division, directed by the order of June 7, 1907, is too bald to need to be stated. The Chicago & Alton, in the letter which it sent to Washington before taking its claim to court, protested also against fines for late trains, against furnishing rent free in stations, the performance of messenger service and other well known unreasonable requirements now in force; but these points are not dealt with in the decision, and on the Alton, as on the other roads, remain to be fought out in the future. The messenger service alone constitutes one glaring absurdity. A certain small road has a mail route of 10 miles, terminating at one end about 1 mile short of the post office, and, under the law and the regulations, must carry the mails that mile; and it collects pay for 11 miles. But the wages of the messenger for this eleventh mile amount to nearly double the sum that the road receives for the 11 miles!

THE STAMFORD COLLISION.

THE salient feature of the wreck which occurred at Stamford, Conn., last week is that, as regards cause, it comes within the same class as those at Bridgeport, in 1911, and at Westport, in 1912. In all three the trouble centered in the cab of the locomotive—failure to control speed. In each of the three cases there were two men in the cab, all of the six long familiar with locomotives, and thoroughly acquainted with the road. That three such notable disasters, happening within a space of 20 miles, should arouse the public, is not surprising, even if the Massachusetts and Rhode Island critics of Mr. Mellen were to be left out of the account. For the newspapers to call for drastic remedies and the theorists to demand the general adoption of automatic train stops is but natural; though it is gratifying to see that the press is somewhat more rational in its criticisms than on former occasions. Since the widespread discussions of the past year, the fact that many of the problems met by the railway manager in his quest for safety are intricate and difficult seems to be better appreciated.

As the evidence, at this writing, is not all in, a conclusion as to the responsibility for the collision would be out of place; but the main facts may be traced with little chance of error. Doherty had been a "qualified" locomotive runner for over a year, but he had actually had charge of an engine, outside of yards, only a small part of this time, and had run passenger trains less than ten days altogether. He had run a 125-ton engine only three days. He had had ten years' experience as fireman, with a good record, but whether during this time he had been well taught by his engineman, and whether he had learned all about the responsibility felt by the runner of a fast train when he is behind time and dreads to meet the criticisms of the trainmaster, are questions on which no light has been thrown, except the brief statement of the road foreman. (A young runner, on his first passenger runs, usually experiences these anxieties even if he is not behind time.) A natural conclusion would be that, being young and inexperienced, Doherty did not realize the importance of insisting, at all hazards, on prompt and adequate attention to his complaint that the air brakes were not in satisfactory condition, and of running his train with extreme caution until his brakes were made satisfactory. As we have said, this is a natural conclusion. The alternative conclusion is that he was not lacking in caution, on this particular run, but that the air brake apparatus failed in some unaccountable way after he had passed the last block station (where he slackened speed and, so far as appears, found no special trouble with the brakes). The absence of any de-

tailed criticism of the brake apparatus, the testimony of the road foreman as to the cause of the failure to stop at Bridgeport on Tuesday, and the testimony of other runners that the brake apparatus of this engine had behaved all right, discredit this conclusion. It remains to be seen whether it will receive support from evidence yet to be brought out.

Whether the brake apparatus was or was not any less efficient at Stamford than it had been on the two days preceding, two or three lessons are already quite plain. For one, the rule that an engineman with a year's experience as spare runner, possibly all on freight trains, shall be deemed fit to run a fast passenger train, with an engine much more powerful than those to which he is accustomed, is, obviously, inadequate. It assumes that the year's experience will have been varied and will have educated the runner. In this case it was not varied. Real, not constructive, experience is the only kind that will surely fit a man for fast trains. Apparently, Doherty ought to have had the road foreman or some other competent guide with him on the big engine many more trips than he did. It is evident also that the efforts of the officers of the road to train the engineman since last year's disaster, though vigorous, were not sufficiently vigorous. Mr. Woodward said that the epidemic of carelessness (or ignorance) was as surprising to the officers of the road as to the coroner. But, surely, after six months, the division officers must have some inkling of the reasons. It may seem harsh to demand further effort from officers who say that the State and Federal commissions are taking up all their time; but, surely, in the matter of safeguarding fast trains it may well be questioned whether duties connected with close supervision of enginemen ought not to take precedence over a summons to a protracted government hearing, where lawyers ask a thousand useless questions—even at the risk of being in contempt of court!

The mind of the runner of a fast train has constantly to act in opposite directions under high pressure; on the one hand he must keep within the bounds of safety and on the other he must make time. If the power of his engine is ample and he has no trouble with fire or water, the second horn of this dilemma may be easy; but uncertainties are usually not far distant and, as we see in this case, a powerful engine is not a sure protection against anxiety. It may be that Doherty, like Wisker, the New York Central engineman whose tragic failure in New York City in 1902 made such a profound impression, is a man who can make a good record in an examination and in the work of a fireman, but who lacks the right temperament to be an express engineer. The peculiar demands to be cautious, and to be bold, alternating every few minutes, or oftener, call for a mental poise or self control that, except in rare cases, can be acquired only by experience. Except as the road foreman can testify from personal knowledge that young runners have had that experience, the superintendent's confidence must depend on a bunch of uncertain factors. Judging by the small number of road foremen on many roads, the New Haven is not the only company which has accepted constructive or presumptive experience as satisfactory.

What have the Interstate Commission's or the Connecticut Commission's investigations done for the public? As we have said, the main problem is the same now that it was in 1911; how to get the most competent and reliable enginemen. The successive accidents have been studied, and various things have been officially proposed as remedies; but on this most vital point nothing has been done. Everybody wants to know what kind of men the New Haven road employs as engine runners, and how they are disciplined. People asked the same questions two years ago, and also on the occasion of the subsequent accidents, but our costly governmental machinery has given them no answer. When an officer of the road says that there has been a lot of bad luck, an explanation is needed; for safety in travel is too important an issue to be trusted to "luck," so long as there is any possibility of finding a better course.

BULLETINS COMMENDING EMPLOYEES.

WHAT is the value of a "roll of honor" for railroad employees who do specially meritorious acts? Without attempting to answer this question with definiteness it may be said that such a list of names is prized in proportion to the rarity of the cases in which men are held to be entitled to a place in it. If the aim of the officer in charge is to record acts of "conspicuous" bravery or devotion (to use the words of some of the general managers' announcements) he must, to fully carry out the idea, be careful not to include commonplace acts. The "safety-first" movement has made rolls of honor so numerous that there is a considerable variety of treatment of the subject; and it would be a good thing if there could be a standard to which all railroad managers could conform. Occasions for acts of special bravery, as that term is usually understood, are rare; but "devotion" and "loyalty" include every-day matters concerning which it is doubtful whether they should be made the subject of special public commendation; the occasions would be too numerous. A line must be drawn somewhere; and if it must be an arbitrary line there ought to be some little discussion of the subject, so that whatever is settled on shall meet the views of the majority. That specific commendation of subordinates by a superior is a good thing, on general principles, is too obvious to need argument; the only serious questions concerning public commendations are When? To whom? What for? It would be profitable, no doubt, for nearly everybody who supervises the work of others to consider whether he ought not habitually to be more prompt, frank and generous in expressing commendation by a personal word or by a brief and informal note; but that is beyond our present purpose; the subject in hand is "rolls of honor"—commendatory notices made known all over the road.

George R. Brown, superintendent of the Fall Brook Coal Company's Railroad and the originator of "Brown's discipline" (about 1886) was a pioneer in the systematic use of commendatory written notices and letters in the railroad service, and perhaps *the* pioneer; though there were superintendents who took a "human interest" in their subordinates long before his time, and they did not always stifle their natural inclination to praise good work. With the advent of "safety first," which has stimulated men of all classes to try to correct things that are wrong, public commendation has become the fashion on roads which do not employ Brown's methods in other respects.

Brown dealt more particularly with cases where a man had manifested good judgment in an undertaking of some magnitude, and where the appropriate thing to do was to write a letter; such as the case of a conductor who did well in clearing a wreck, or one who skilfully managed a lot of trains in a difficult emergency. With the introduction of Brown's discipline on large roads his discriminating, personal management of this matter was to a large extent superseded by practices suggestive of machine methods; and such commendations as have been made public, while still rational and usually justified, seem not to have received the careful attention of officers which their importance demanded.

One possible rule, quite simple, would be to use different terms in commending a man for going beyond his duty to avert damage or disaster from what would be used for the same act in the line of duty. A station agent, sitting in his office, and averting a derailment by reporting a fallen brake beam in a passing train is to be commended; and so is a brakeman on the train who makes a similar discovery. The brakeman, however, is only doing his duty. But he is to be commended for that. There is no use in decrying the practice of praising the simple performance of duty. There will always be a few warm-hearted souls who will follow that practice, and others may as well fall in line. The only care required is to see that good judgment is exercised. It is well not to "slop over." The same man who is praised today may have to be reprimanded within a short time. But the station agent, in our supposed case, is

on a footing different from that of the brakeman. Not the slightest fault is to be imputed to the agent if he does not watch every truck of a passing 80-car freight train. And yet it is his duty to promote safety in every reasonable way. In his office, when not engrossed in work, he may be talking to a passenger, or may be engaged in unprofitable conversation; he may be half asleep or may be gazing out of the window with an empty mind. Commendation for noticing a defective car, therefore, cannot be said to suggest to the agent the definite idea of a specific duty; but probably it will be useful as a stimulus to habitual thoughtfulness concerning the safety of trains. This, however, is well worth while, is it not?

The coldest theory is that men *must* be reprimanded for falling below par; and that, logically, commendation is appropriate only when their conduct goes above par. With a record just reaching par, nothing special is called for. In that case the pay roll provides for the only and the sufficient recompense. But, surely, this theory cannot be said to embody the highest standard. It has been followed widely, and through a long period of years; and as we are still far from perfect, no very specific fault can be found with managers or superintendents who try a policy less austere; at least not until unfavorable results are manifest because of the change.

Superintendents, trainmasters and others who have to decide on the awards to a considerable number of employees in matters like those here mentioned would do well to tell of their experiences; to report their successes and their difficulties, for the benefit of others who have to deal with the same problems. To aid in the carrying out of this suggestion we append a few notes on the honor rolls of a half dozen prominent roads. The items in these records, of which we notice only a small fraction of those for a single month, range all the way from heroism down to everyday duty; bravery, quick wit, the ordinary wit of an alert mind, unusual promptness in doing a duty, and simple faithfulness. How many classes should our roll of honor contain?

One of the things sure to be noticed, apparently, is the discovery of a fire and preventing it from doing damage. On the Illinois Central a brakeman, for this, had "favorable entry" made on his record. The *Illinois Central Magazine*, however, uses this phrase for everything, and "meritorious service" is the heading, not "roll of honor." How favorable was the mention, is not stated. On some roads a definite number of marks is announced. Whether this fire was in the brakeman's own train is not stated. On the Rock Island a brakeman was credited five marks for firing an engine when the fireman was taken sick. Another one, a few weeks later, received the five merits and also a letter of commendation. This one prevented an embarrassing delay to a red ball train.

Firemen also get credit when they fire for a sick man. One on the Illinois Central, called in an emergency of that kind, and being sent over another road to the point where the train was in distress, was stranded, by his train being indefinitely delayed; and he got off and walked, ten miles, through a snowstorm, to the point where he was needed.

On the Rock Island a passenger engineman received a letter of commendation for responding, when off duty, to a call to run a switching engine. Some *conductors* of passenger trains might be embarrassed by a call to thus go back to early days; they would feel that their technique was too rusty!

On the Missouri, Kansas & Texas a conductor, presumably freight, was given 20 days' credit for "noticing something wrong" under his train. He found a spring plank dragging. This item in the record serves as a reminder that credit may be due even if no definite defect be discovered—and even if there be doubt whether anything at all is actually dangerous. When "something wrong" is discovered about a moving train, a conductor or trainman must immediately think of Rules 105 and 106—take no risks.

On the Buffalo, Rochester & Pittsburgh a conductor was commended for acting promptly on his discovery of marks on the ties after a train had passed. The despatcher was enabled to stop the train and have a fallen brakebeam attended to.

On the same road a conductor was commended for discovering a bent axle on a foreign freight car—perhaps because bent axles are not easy to discover. On the Rock Island a conductor received a "letter of appreciation" based on good work done in connection with repairing an engine. On another road a conductor and his whole crew received "favorable mention" for picking up a lot of scrap brass and rubber.

Other kinds of specially commendable service are: a switchtender assisting a brakeman, in the yard, who was in danger of losing control of his cars; an agent noticing an open door in a passing freight train, in freezing weather, and sending a message which saved the fruit in the car; an operator discovering a sliding wheel, and a bridge watchman stopping a train which had a brakebeam dragging. A car inspector reported a broken rail. On the Illinois Central a number of conductors got favorable entries by detecting improper or fraudulent use of passes; a part of their duty, but a part often shirked. A freight checker on the B. R. & P. found that a car had been robbed, followed two suspicious looking men and, having got a police officer, had them arrested; and they were tried and convicted.

As a final suggestion toward answering the questions that have been outlined we will cite the last issue of *Safety*, a "Periodical of Progress and Protection," which is issued by the New York Central Lines. It is Volume 1, Number 2, and is edited by Marcus A. Dow, secretary, New York City. Of the twenty pages of this pamphlet two are occupied by the "roll of honor." One of the two is filled with the notes on five cases (and the portrait of an operator who stopped a train in which was a broken wheel); and on the other page is a list of 24 other cases, each item giving name, occupation, town and date, and filling only one line. This condensation is to be commended. No one would wish to detract in the least from the credit due any employee, but news published 500 miles from the place where it happened inevitably suffers by the mere fact of distance. If detailed notices are the more desirable then it is a question whether they would not better be confined, in their circulation, to a single division of the road, or some small territory where they would be most appreciated. Editor Dow apparently picked out, for his first page, the five most notable cases, from the whole 29 before him; but often it would be difficult, probably, to make a fair selection. A record of exceptional things must be somewhat one-sided, because circumstances for which the individual person deserves no credit usually figure as one of the main elements in the case. A hero often has to credit his heroism partly to "luck." The propriety of publishing portraits is questionable. We do not presume to criticise definitely in the present case, for the whole matter is still in the experimental stage; but where can one draw the line in the matter of portraits?

Private, personal commendation is a practice which every superior, even the superior of a very few employees, will find profitable. Even if he make mistakes, he will soon discover how to avoid mistakes in the future; and the correcting process will be good exercise. (The word "private" as here used is not necessarily synonymous with "secret.") But as to printed notices, to be published throughout a railroad system of 5,000 to 10,000 miles, there is room for discussion.

The *Baltimore & Ohio Employees' Magazine* for May contains an extreme instance of the difficulty of doing the satisfactory thing. In the Ohio floods of last March that company lost $3,000,000 worth of property and, in addition, suffered a shrinkage of $2,000,000 in freight and passenger receipts. Vice President A. W. Thompson, commending the devotion to duty of thousands of employees, says that "it is difficult to find suitable words of comment." The best that he could do was to direct that credit be entered on the record of every employee who assisted in restoring the road to normal condition, and that "the record be made in red ink."

DEPRECIATION IN RAILWAY VALUATION.

C. F. LOWETH, chief engineer of the Chicago, Milwaukee & St. Paul, discusses in a letter published elsewhere the editorial in our issue of May 30 on "Some Disputed Points in Railway Valuation: Depreciation." It will help to an understanding to state that the editorial Mr. Loweth refers to was not meant to deal with valuation for the purpose of purchase, but solely with valuation for rate-making. Furthermore, it was meant to be rather a statement of opposing views and practice than a discussion of the correct way to deal with depreciation in making a valuation for rate-making.

Whether one will believe that a deduction for depreciation should be made in valuation for rate-making will depend largely on his theory as to the way railway rates and profits should be regulated. The theory now most generally accepted is that ordinarily a railway company is entitled only to a fair return on the fair value of its property, and that the main factor in fair value is the cost of reproduction of the physical property. Assuming that that principle is correct, the question to be considered here is, what deduction, if any, should be made from the cost of reproduction new because of depreciation.

Mr. Loweth apparently takes the position that, in valuation for rate-making, no such deduction should be made. Let us test this by some hypothetical cases. When the construction of a railway has just been finished, doubtless its actual cost should be accepted as its cost of reproduction new. Depreciation of its ties, rails and so on immediately sets in, and will not for some years be offset by renewals, simply because there is no sense in renewing things the depreciation of which has been so slight as not measurably to affect their serviceability. *Other things being equal,* the fact that the necessary expenditures for maintenance during the first few years are relatively small will nominally keep down operating expenses and increase net earnings. In consequence, the nominal net earnings during this period may be more than a fair return. The management may pay out the net earnings nominally in excess of a fair return in dividends. As time goes on, however, the amount of renewals that have to be made annually increases until finally a point is reached when year by year depreciation is just offset by expenditures for maintenance. Meantime, *other things being equal,* the increasing cost of maintenance has increased operating expenses and reduced net earnings, so that there are now no surplus earnings over a fair return, and only a fair return can be paid. At about this time a commission comes along to make a valuation for rate-making. The original cost of the road was $50,000 a mile. The commission ascertains that this would be its present cost of reproduction new, but holds that a deduction of $2,500 a mile should be made for depreciation because the depreciation of the ties, rails and so on since they were put in service has actually decreased the value of these parts of the road that much. The railroad protests against this deduction because if its valuation is made only $47,250 a mile, and its rates are adjusted accordingly, it will be unable to earn a fair return on the original investment of $50,000 a mile. The commission, in reply, points out that the earnings in excess of a fair return which have been paid out in dividends amount to $2,500 a mile, which just equals the amount of the depreciation; takes the position that, in effect, the stockholders have received back this much of their principal; and therefore holds that they have no right to complain if it is not included in the valuation on which they are in future to be allowed a return. Is the commission right?

Perhaps the question will be made easier to answer by changing the illustration. Suppose that during the first few years of the road's history, when the necessary renewals were small, the nominal operating expenses relatively small and the nominal net earnings in excess of a fair return, the management had recognized the fact that depreciation really was going on, even if it was not necessary yet to take it up in the maintenance expenditures, and had paid the stockholders only a fair return, investing the nominal surplus net earnings in additional ballast, the filling in of wooden trestles, and other improvements costing, all told, $2,500 a mile. When the valuation was made the management naturally would contend that these expenditures from earnings should be included in the value of property investment. Would it be right?

Railway officers will have no difficulty in answering this question in the affirmative. But if appreciation due to expenditures from earnings for some parts of the property should be considered in a valuation, why should not depreciation of some other parts of it be considered? It is a poor rule that will not work both ways. Of course, every one knows that actually a new road ordinarily falls far short of earning a "fair return."

Mr. Loweth says that "if the valuation of the property is for rate-making purposes, then no account of the depreciated condition of the property need be taken, as the owner will be obliged to continue to maintain it, and must necessarily be allowed a sufficient return over and above the interest on the investment and the cost of operating the property, to take care of all appreciation."

If the owner has been allowed to earn enough for all these purposes, and has used the earnings for them, then there is no depreciation to be allowed for in a valuation, simply because there is no depreciation in fact. If he has not earned enough for all these purposes, and his property has been managed with reasonable prudence, he is clearly entitled to be reimbursed with earnings more than sufficient for all these purposes in future. And if he has earned enough for all these purposes, but has failed to use in the maintenance of the property the funds that were needed to prevent depreciation, why, on the same principle, should not an allowance for depreciation be made in the valuation of his property?

Innumerable editorial discussions of valuation have been published in these columns during the last five or six years. In view of them it is doubtless needless to say that the *Railway Age Gazette* firmly believes there are many things that should be considered in railway valuation besides the original cost and the depreciation and maintenance of the various elements of the property. What has been said in the foregoing has been intended only to bring out clearly our reasons for thinking that depreciation of certain elements of the property is a factor to be considered. Consideration of it is made no less necessary because it may be many times more than offset by appreciation due to adaptation and solidification of road bed, to increased value of real estate, to permanent improvements made from earnings, and to the going value inherent in an old and established concern. These elements and many others ought to be considered; and there can be no doubt that if a fair valuation is made these things will be found in the cases of a great majority of roads to weigh many times heavier than any allowance that can properly be made for depreciation.

Furthermore, it is far from our intention to convey the impression that we believe the interest and dividends, or the net earnings, of individual railways should be limited to any arbitrary percentage on their valuations, even though such percentage be given the specious name of a "fair return." In the first place, it would be physically impossible to make different roads operating in the same territory, but having widely different densities of traffic and operating expenses, earn the same percentages of return on their valuations, no matter how rates were adjusted. In the second place, to restrict all to the same return would be unjust and inexpedient even if it were possible, because what would be a "fair return" for a railway that is incapably and expensively managed would be a wholly unfair return for one that is ably and economically managed. The conditions to be dealt with in regulating railway rates, securities and profits are so exceedingly complex that the difficulty of making a valuation that will give due weight to all the factors that should be considered will be very great. The difficulty of making any practical use of the valuation after it is finished will be yet greater.

Letters to the Editor.

MR. LOWETH ON DEPRECIATION IN VALUATION.

Chicago, June 3, 1913.

To the Editor of the Railway Age Gazette:

The editorial in your issue of May 30 entitled, "Some Disputed Points in Railway Valuation: Depreciation," seems to me to come quite wide of hitting the mark.

Whether depreciation should be considered or not, depends entirely upon the purpose for which the valuation is made. If the property is to change ownership from a ready seller to a willing buyer, the valuation should take full account of depreciation. If the owner, in the case of a railroad, has for several years renewed less than the due proportion of rails and ties, or otherwise has let the property run down, he has profited to that extent, and has thereby placed a greater burden of future maintenance on the property, which the prospective purchaser should take into account. Of course, property is sometimes sold when for certain reasons either one or both of the parties to the transaction are willing to overlook depreciation.

If, however, the valuation of the property is for rate-making purposes, then no account of the depreciated condition of the property need be taken, as the owner will be obliged to continue to maintain it, and must necessarily be allowed a sufficient return over and above the interest on the investment, and the cost of operating the property, to take care of all depreciation.

It is presumed that the kind of valuation referred to in your editorial is that made by the various states, and now proposed to be made by the Federal authorities, of the railroads of the United States; and unless it is a question of the purchase of these properties, it is difficult to see what would be gained by taking into account depreciation or "condition per cent.," as it is sometimes termed, except, possibly, for the purpose of determining the fair average rate of depreciation to be allowed to the owners of the properties, in addition to the costs of operation, interest and profit.

C. F. Loweth,
Chief Engineer, Chicago, Milwaukee & St. Paul.

THE DANGER OF HIGH FIXED CHARGES.

Washington, D. C., June 14, 1913.

To the Editor of the Railway Age Gazette:

The history of railway financing, culminating in the St. Louis & San Francisco misfortune, raises doubt as to the propriety of the government allowing public carriers to increase their indebtedness ad libitum. In 1900 the amount of railway funded debt outstanding, based on official sources, bore a proportion to railway capital stock of 96.56 per cent., in 1905 110.62 per cent., and in 1910 126.98 per cent. The inquisitive observer wonders whether he will live long enough to see the outcome. Obviously there may be two kinds of restriction on the ever increasing tendency to expand funded debt: (1) the natural or economic, and (2) the artificial or governmental. The first is to be most dreaded because it comes with unexpected force and is curative only; the second is to be most desired, because it establishes in advance a rule of action and is preventive rather than curative.

Doubtless the railways are in the hands of their friends, the investors, who in the main appear to prefer bond investments, hence the floating of new bond issues goes on unchecked. But bankruptcy brings railway manager, stockholder, and bondholder alike into predicament; the manager loses control, the stockholder steps down and out, and the bondholder is forced against his will to become a stockholder. Nor is the conversion of bondholdings into stockholdings a painless and inexpensive metamorphosis. Many a stockholder today was formerly a bondholder and now faces another set of bondholders. Perhaps the shipper and the employee should be allowed to get in a word edgewise as to their opinion in the matter.

The force that lies behind a debt cannot be minimized by calling it "funded" debt or "bonded" debt; the day of maturity arrives strictly on time. A reasonable amount of borrowed capital may be used with profit and advantage to all parties, but there must be a safety valve somewhere. The schoolboy asks, "Why have stockholders at all?" "If the railways can borrow in amount beyond 100 per cent. of their capital stock, why not borrow the entire necessary capital and let the bondholders operate the road?" While the question is illogical, it suggests a serious proposition, which is that every road should be prohibited by law from borrowing capital in excess of its capital stock, and also should not be granted permission by the regulating commission to issue bonds in excess of, say, 90 per cent. of its capital stock unless extraordinary necessity can be shown.

E. S. Hobbs.

PROPOSED NATIONAL VALUATION CONVENTION.

Chicago, April 17, 1913.

To the Editor of the Railway Age Gazette:

Referring to your issue of April 11, 1913, page 836, on "National Valuation Convention Urged," I beg to comment as follows:

In my opinion, a convention such as that proposed would be so large and unwieldy that no results could be accomplished. If one valuation engineer from each railroad system was included this item alone would mean 1,306 men. The American Railway Association, the American Railway Engineering Association and the Interstate Commerce Commission have thus far appointed no valuation commissions, therefore could not be represented. A large number of consulting engineers are, or have been engaged more or less upon valuation of public utilities. These latter would not be especially equipped to handle railway valuations.

If the convention were represented by members as proposed there would be upwards of 2,000 in such a conference, a multitude among which no decision upon a single point could be made unanimous.

It is a mistaken idea that railways are not equipped to properly make valuations of their properties. Among the western roads, especially in states where valuations have already been made to state commissions, this work is already well in hand and with little effort can be systematized and made uniform. The forms, methods, unit prices, depreciation, engineering interest, appreciation, adaptation, solidification and seasoning and the many other items entering into a valuation are already well established, and while it is true differences exist among the various valuations already prepared, the difference is in degree only and the principles are well established.

Any well organized engineering department of our railways is already equipped, or can be so equipped on short notice to perfect an organization to value its property.

When the Interstate Commerce Commission promulgated the classification of operating and construction expenses on railroads, Prof. Henry C. Adams, statistician of the commission, was aided in the work by a "Committee of Twenty-five," who were representatives from the accounting departments of representative railways, and this committee succeeded in establishing a classification, which has as important a bearing on the interests of the railroads as the valuation of its properties is likely ever to have, and if such an important work can be accomplished by such means, it would be more practicable if the Interstate Commerce Commission would invite the railroads to appoint as representatives at a conference about twenty-five men, composed of railroad engineers and accountants who would meet with the Interstate Commerce Commission officers and promulgate rules and establish principles covering every item entering into a railroad valuation. Real constructive work and definite results would be more readily and satisfactorily accomplished by such a body than a mass meeting of 2,000 persons, each having divergent views.

L. C. Fritch,
Chief Engineer, Chicago Great Western.

THE SUPREME COURT'S COMMENTS ON VALUATION

In the Minnesota Rate Case the Supreme Court in the Opinion by Justice Hughes Discusses Railroad Valuation.

The following is an abstract [omissions consist principally of citations and are indicated thus * * *] of that part of the Minnesota Rate Case decision dealing with valuation:

The rate-making power is a legislative power and necessarily implies a range of legislative discretion. We do not sit as a board of revision to substitute our judgment for that of the legislature, or of the commission lawfully constituted by it, as to matters within the province of either. *San Diego Land & Town Co.* v. *Jasper,* 189 U. S. 439, 446. The case falls within a well defined category. Here we have a general schedule of rates, involving the profitableness of the intrastate operations of the carrier taken as a whole, and the inquiry is whether the state has overstepped the constitutional limit by making the rates so unreasonably low that the carriers are deprived of their property without due process of law and denied the equal protection of the laws.

The property of the railroad corporation has been devoted to a public use. There is always the obligation springing from the nature of the business in which it is engaged—which private exigency may not be permitted to ignore—that there shall not be an exorbitant charge for the service rendered. But the state has not seen fit to undertake the service itself; and the private property embarked in it is not placed at the mercy of legislative caprice. It rests secure under the constitutional protection which extends not merely to the title but to the right to receive just compensation for the service given to the public.* * *

In determining whether that right has been denied, each case must rest upon its special facts. But the general principles which are applicable in a case of this character have been set forth in the decisions.

(1). The basis of calculation is the "fair value of the property" used for the convenience of the public. * * *

(2). The ascertainment of that value is not controlled by artificial rules. It is not a matter of formulas, but there must be a reasonable judgment having its basis in a proper consideration of all relevant facts. The scope of the inquiry was thus broadly described in *Smyth* v. *Ames.* * * *

(3). Where the business of the carrier is both interstate and intrastate, the question whether a scheme of maximum rates fixed by the state for intrastate transportation affords a fair return, must be determined by considering separately the value of the property employed in the intrastate business and the compensation allowed in that business under the rates prescribed. This was also ruled in the *Smyth* case (*id.* p. 541). The reason, as there stated, is that the state cannot justify unreasonably low rates for domestic transportation, considered alone, upon the ground that the carrier is earning large profits on its interstate business, and, on the other hand, the carrier cannot justify unreasonably high rates on domestic business because only in that way is it able to meet losses on its interstate business.

In the present cases, the necessity of this segregation of the domestic business in determining values and results of operation, was recognized by both parties. Voluminous testimony was taken before the Master, and numerous exhibits containing data and calculations were submitted for the purpose of showing their respective estimates of the value of the entire property of the carriers in Minnesota, the amount of income and expense in that state, their theories of apportionment between the interstate and intrastate business, and their contentions as to the net return for intrastate transportation under the state rates. The multitude of facts which are involved makes it impossible here to present a comprehensive review, even in a summary way. We must be content with a statement of the salient points and deal only with those matters which, after a careful consideration of the entire record, we regard as controlling our decision.

In each of the three cases (save in certain particulars, which we need not now mention, with respect to that of the Minneapolis & St. Louis) the method adopted by the Master was as follows:

The period taken for the purpose of testing the sufficiency of the rates was the fiscal year ending June 30, 1908. During this period, all the rates in question, freight and passenger, were actually in force, with the exception of the commodity rates prescribed by the act of April 18, 1907, which had been enjoined. The amount of the reduction in the intrastate revenue which would have been caused by the application of the commodity rates is shown.

The Master found the present value of the entire property of the carrier, used in the public service in the state of Minnesota. This valuation was as of June 30, 1908, and was made on the basis of the cost of reproduction new. The Master also made findings as to the original cost of construction, and as to the present value on the basis of cost of reproduction new, of the entire system of the carrier. The estimated value of the railroad property within the state was divided between the freight and passenger business upon the relation of the gross revenue derived from each. The part of the total value which was thus assigned to the freight business within the state was then divided between the interstate and intrastate freight business on the basis of gross revenue; and a similar division was made between the interstate and intrastate business of the property value assigned to the passenger department. In this way the Master found the value of the property used in intrastate transportation, freight and passenger, upon which he computed the net return received by the carrier.

There was no substantial dispute as to the amount of the entire revenue assignable to the state or as to its division between interstate and intrastate business, as an examination of the transactions in which the revenue was obtained permitted the making of the requisite apportionments with reasonable certainty.

The Master also ascertained the total expense incurred by the carrier within the state. This expense was first divided between freight and passenger business. Those items of cost which were directly incurred in each sort of business, and not common to both, were directly assigned; and such items were found to cover about 60 per cent. of all expenses. The remaining items, those of common expense, were divided between the freight and passenger business upon the relation, as to most of them, of revenue train-miles, and others, of revenue engine-miles.

Having thus ascertained the share of the expense within the state of the freight and passenger departments respectively, it remained to divide that share, in each case, between the interstate and intrastate business. This apportionment was made, in the case of freight expense, upon what was termed an "equated ton-mile basis"; and in the case of passenger expense upon an "equated passenger-mile basis." That is to say, the Master concluded that the cost per ton-mile of doing the intrastate freight business was at least two and one-half times the cost per ton-mile of the interstate freight business, and hence he divided the total freight expense according to the relation of the interstate and intrastate ton-miles after the latter had been increased two and one-half times. In the case of the passenger expense, he concluded that the cost per passenger-mile in the intrastate business was at least 15 per cent. greater than that in the interstate business, and the total passenger expense was divided upon the relation of passenger-miles after increasing the intrastate passenger-miles 15 per cent. By the use of equalizing factors, the same result was obtained upon what was called an "equated revenue basis."

The net profits of the interstate and intrastate businesses, respectively, passenger and freight, were then found by deducting the apportioned share of expense from the apportioned share

of revenue, and the rate per cent. of the net profit upon the property value assigned to each sort of business was computed. The Master concluded that the returns from intrastate transportation were unreasonably low and hence that the rates in question were confiscatory.

The validity of the result depends upon the estimates of the value of the property within the state and the apportionments both of value and of expense between the interstate and intrastate operations.

It will be convenient to take up the three cases separately:

Northern Pacific Railway Company.

The par value, April 30, 1908, of the stock of this company was found to be $215,539,634.99, and of the bonds $190,256,577.66; total, $405,796,392.65. (Included in this statement of capital stock is the sum of $60,539,634.99 received to April 30, 1908, upon subscriptions to new capital stock ($95,000,000) authorized by stockholders' resolution January 7, 1907.)

These securities and their value in the market rest upon the entire property of the company. They include assets of considerable value (for example, the stock of the Northwestern Improvement Company owning extensive coal lands) which, however, do not form part of what may be called the operating property of the company or that devoted to the public service, upon which the fair return is to be calculated (15 I. C. C. 376, 397, 407). Referring to the market value of the securities, the Master said: "Assets and property not devoted to public service have not been valued, and as they are a large element in stock valuation it follows that value of bonds and stocks is wholly unreliable and cannot be used in these cases as an element in determining the value of operating property or as a basis for rate-making." In this view the Master was undoubtedly right.

Much evidence was produced before the Master for the purpose of showing the actual cost of construction and equipment of the entire railroad system from the beginning down to April 30, 1908. This, the Master states, could be shown only by the corporate books and records; and in the early history of the original company these are somewhat obscure and uncertain and, by reason of lapse of time, could not be verified by other proof. The total investment cost of the railroad system of the Northern Pacific thus shown, was $369,252,755. This included certain items which the Master held not to be properly allowable as a part of the cost, and after their deduction the cost was found to be $312,243,555. Of this investment cost, it appears from the evidence submitted by the company's controller that the sum of $128,184,985.82 was expended for construction and equipment, and for improvements and betterments, during the period from September 1, 1896, to April 30, 1908. The Master found that the Minnesota track mileage is substantially 21 per cent. of the track mileage of the whole system and that if the cost were apportioned accordingly, the amount assignable to the state of the entire cost of construction and equipment, as stated, would be $65,571,462.

The Master, however, and the court below in confirming his findings, held that rates were not to be predicated upon the original investment.

Taking, as the basis, the cost of reproduction new, the Master found that the value of the entire railroad system or operating property of this company to be $452,666,489. The value of that portion of the system which was in the state of Minnesota was separately found, on the same basis, to be $90,204,545. It was upon this estimate of the value of the property in the State, as apportioned between the interstate and intrastate business, that the Master computed the rate of return.

The total net profits of the company for the fiscal year ending June 30, 1908, from its Minnesota business (interstate and intrastate) was found to be $5,431,514.56. This was equal to 6.021 per cent. on the entire estimated value of the property. This showing of the results of the entire business at once directs attention to the importance of the methods adopted in making apportionments, but before considering these, the question is presented as to the soundness of the underlying estimate of value. May it be accepted as a basis for a finding that the rates are confiscatory?

Values. The items entering into the valuation are 40 in number.

The first item is:

"Lands for right-of-way, yards and terminals—$21,024,562."

This is for the bare land, without structures or improvements of any sort, as the entire cost of reproduction in building the road and erecting all the existing structures is covered in other items. The Master states that the amount thus allowed for land is made up as follows:

Terminal properties, St. Paul appraisement of Read, Watson & Taylor, as modified by railroad company	$7,645,100.24
Add 5 per cent. for the cost of acquisition and consequential damages	382,255.01
Property acquired after appraisement	328,725.69
Minneapolis appraisement of Elwood, Barney and Ridgeway, as modified by railway company	4,027,616.17
Add 5 per cent. for acquisition and consequential damages	201,380.80
Property acquired after appraisement	227,737.26
Duluth, appraisement of Stryker, Mendenhall and Little	3,602,443.43
Add 25 per cent. for railway value, cost of acquisition and consequential damages	900,610.85
Total value of terminals	$17,315,869.45
Lands outside of terminals	3,708,693.45
Grand total	$21,024,562.90

The appellants insist that no more than $9,498,099.27 should have been allowed.

It is contended that the valuation was made upon a wrong theory; that it is a speculative estimate of "cost of reproduction"; that it is largely in excess of the market value of adjacent or similarly situated property; that it does not represent the present value, in any true sense, but constitutes a conjecture as to the amount which the railway company would have to pay to acquire its right-of-way, yards and terminals, on an assumption, itself inadmissible, that, while the railroad did not exist, all other conditions, with respect to the agricultural and industrial development of the State, and the location, population and activities of towns, villages and cities, were as they now are.

We may first consider the basis for the finding with respect to the "lands outside terminals," that is, the right-of-way and station grounds, etc., outside the three cities.

(a) *Lands outside terminals.* The complainants' witness was Mr. Cooper, the land commissioner of the company, who has charge of the land grants for its entire system, of its right-of-way and land purchases, and has had a wide experience in connection with land values along the lines of the railway. In the latter part of 1906, the state notified the company to report the value of its properties, requiring a statement in one column of the "market value" and in another column, of the "value for railway purposes." Mr. Cooper was instructed to prepare the valuation for this report. From the information he received in special inquiries, and his own knowledge, and following what he understood to be the instructions from the state, he set down under the heading of "market value," not the market value in the proper sense of that term, but what in his judgment it would cost the railroad company to acquire the land. This included an excess which he estimated the company would have to pay over the market value of contiguous and similar property if it were called upon to undertake such a reproduction of its right-of-way. It did not, however, embrace an allowance for payments which might have to be made for improvements that possibly might be found upon the property in such case, or for the consequential or severance damages which might possibly have to be met, or for the expense of acquisition. These supposed additional outlays he undertook to estimate. For this purpose he increased the "market value" as stated (in the case of agricultural lands generally multiplying it by three) and thus reached the amount set down as the "value for railway purposes." * * *

The "market value" of the lands (outside of the three cities), thus fixed and reported to the state was $2,008,491.50, and the increased amount estimated, in the manner stated, which was reported as the "value for railway purposes" was $4,944,924.60.

The latter amount was submitted by the complainants in this case as the value of the lands. The Master thought that the complainants' witness used too large a multiplier and allowed 75 per cent. of the amount thus claimed, or $3,708,693.45, stating that this was determined upon as the "fair reproduction value of the property." This allowance, it will be observed, was about $1,700,000 in excess of Mr. Cooper's estimate of "market value" as that term was used in making the report.

(b) *Terminal properties.* This term is used to designate the lands for the right-of-way, yards and terminals in St. Paul, Minneapolis and Duluth. The total original cost of these lands to the company (according to its statement based on the best information obtainable) including purchases to April 30, 1908, was $4,527,228.76. The Master allowed as their value, apart from the improvements made by the company which, as we have said, were embraced in the other items of reproduction cost, the sum of $17,315,869.45.

In preparing the valuation for the report to the state, Mr. Cooper employed real estate men in each of the cities to make an appraisement. He instructed them, as he testifies, "to make a conservative report of the cost of reproducing the properties owned by the company in each of their respective cities." They divided the property into districts and reported their estimate of units of value, as, for example, by the square foot. Mr. Cooper took these reports, discussed their valuations with the appraisers and aided by his own knowledge, formed an independent judgment, in no case increasing and in some instances (with respect to certain St. Paul and Minneapolis property) reducing the appraisers' values. He then set forth under the heading "market value" in the report to the state, as described in the testimony we have quoted, his estimate of what it would cost the company to purchase these lands, exclusive of improvements that might be upon them, severance and consequential damages and expenses incident to acquisition. The amounts he thus fixed were as follows: For the property in St. Paul, $7,645,100.24; in Minneapolis, $4,027,616.17; in Duluth, $3,555,593.93. In the case of the St. Paul and Minneapolis properties the amounts are precisely those adopted by the Master in his findings and to this he adds 5 per cent. to cover cost of acquisition and consequential damages. The Master was of the opinion that the appraisers of these properties were "fully impressed with their value for railroad purposes" and that their appraisement as verified by them before him and modified by the railway company "is a generous valuation and should be accepted as full railroad value of the terminal properties," and it was so accepted with the addition above stated. With respect to the Duluth property, where the appraisement appears to have rested upon the ordinary values of real estate, the Master sets forth as the appraised value, $3,602,443.43, to which he adds 25 per cent. or $900,610.85 "for railway value, cost of acquisition and consequential damages."

In reviewing the findings, the court below reached the conclusion that "the Master in effect found that the cost of reproduction and the present value of the lands for the terminals in the three great cities, including therein all cost of acquisition, consequential damages, and value for railroad use which he allowed, was only about 30 per cent. more than the normal value of the lands in sales between private parties. He found the value of the lands outside the terminals to be only twice their normal value."

From our examination of the evidence we are unable to conclude that the excess stated may be thus limited. What is termed the normal value does not satisfactorily appear. It further will be observed that the amount thus allowed in Item 1 for lands, yards and terminals, both in and out of the three cities ($21,024,562), was included in the total on which 4½ per cent. was allowed in Item 30 for "Engineering, superintendence, legal expenses," and again was included in the total on which 5 per cent. was allowed in Item 37 for "Contingencies," and, in addition, was included in the total on which 10 per cent. was allowed in Item 39 for "Interest during construction."

These are the results of the endeavor to apply the cost-of-reproduction method in determining the value of the right-of-way. It is at once apparent that, so far as the estimate rests upon a supposed compulsory feature of the acquisition, it cannot be sustained. It is said that the company would be compelled to pay more than what is the normal market value of property in transactions between private parties; that it would lack the freedom they enjoy, and, in view of its needs, it would have to give a higher price. It is also said that this price would be in excess of the present market value of contiguous or similarly situated property. It might well be asked, who shall describe the conditions that would exist, or the exigencies of the hypothetical owners of the property, on the assumption that the railroad were removed? But, aside from this, it is impossible to assume, in making a judicial finding of what it would cost to acquire the property, that the company would be compelled to pay more than its fair market value. It is equipped with the governmental power of eminent domain. In view of its public purpose, it has been granted this privilege in order to prevent advantage being taken of its necessities. It would be free to stand upon its legal rights and it cannot be supposed that they would be disregarded.

It is urged that, in this view, the company would be bound to pay the "railway value" of the property. But, supposing the railroad to be obliterated and the lands to be held by others, the owner of each parcel would be entitled to receive on its condemnation, its *fair market value* for all its available uses and purposes. * * * There is no evidence before us from which the amount which would properly be allowable in such condemnation proceedings can be ascertained.

Moreover, it is manifest that an attempt to estimate what would be the actual cost of acquiring the right-of-way, if the railroad were not there, is to indulge in mere speculation. The railroad has long been established; to it have been linked the activities of agriculture, industry and trade. Communities have long been dependent upon its service, and their growth and development have been conditioned upon the facilities it has provided. The uses of property in the communities which it serves are to a large degree determined by it. The values of property along its line largely depend upon its existence. It is an integral part of the communal life. The assumption of its non-existence, and at the same time that the values that rest upon it remain unchanged, is impossible and cannot be entertained. The conditions of ownership of the property and the amounts which would have to be paid in acquiring the right-of-way, supposing the railroad to be removed, are wholly beyond reach of any process of rational determination. The cost-of-reproduction method is of service in ascertaining the present value of the plant, when it is reasonably applied and when the cost of reproducing the property may be ascertained with a proper degree of certainty. But it does not justify the acceptance of results which depend upon mere conjecture. It is fundamental that the judicial power to declare legislative action invalid upon constitutional grounds is to be exercised only in clear cases. The constitutional invalidity must be manifest, and if it rests upon disputed questions of fact, the invalidating facts must be proved. And this is true of asserted value as of other facts.

The evidence in these cases demonstrates that the appraisements of the St. Paul and Minneapolis properties which were accepted by the Master were in substance appraisals of what was considered to be the peculiar value of the railroad right-of-way. Efforts to express the results in the terms of a theory of cost of reproduction fail, as naturally they must, to alter or obscure the essential character of the work undertaken and performed. Presented with an impossible hypothesis, and endeavoring to conform to it, the appraisers—men of ability and experience—were manifestly seeking to give their best judgment as to what the railroad right-of-way was worth. And doubtless it was believed that it might cost even more to acquire the property, if one attempted to buy into the cities as they now exist and all the difficulties that might be imagined as incident

to such a "reproduction" were considered. The railroad right-of-way was conceived to be a property *sui generis*, "a large body of land in a continuous ownership," representing one of the "highest uses" of property and possessing an exceptional value. The estimates before us, as approved by the Master, with his increase of 25 per cent. in the case of the Duluth property, must be taken to be estimates of the "railway value" of the land; and whether or not this is conceived of as paid to other owners upon a hypothetical reacquisition of the property is not controlling when we come to the substantial question to be decided.

That question is whether, in determining the fair present value of the property of the railroad company as a basis of its charges to the public, it is entitled to a valuation of its right-of-way not only in excess of the amount invested in it, but also in excess of the market value of contiguous and similarly situated property. For the purpose of making rates, is its land devoted to the public use to be treated (irrespective of improvements) not only as increasing in value by reason of the activities and general prosperity of the community, but as constantly outstripping in this increase, all neighboring lands of like character, devoted to other uses? If rates laid by competent authority, state or national, are otherwise just and reasonable, are they to be held to be unconstitutional and void because they do not permit a return upon an increment so calculated?

It is clear that in ascertaining the present value we are not limited to the consideration of the amount of the actual investment. If that has been reckless or improvident, losses may be sustained which the community does not underwrite. As the company may not be protected in its actual investment, if the value of its property be plainly less, so the making of a just return for the use of the property involves the recognition of its fair value if it be more than its cost. The property is held in private ownership and it is that property, and not the original cost of it, of which the owner may not be deprived without due process of law. But still it is property employed in a public calling, subject to governmental regulation and while under the guise of such regulation it may not be confiscated, it is equally true that there is attached to its use the condition that charges to the public shall not be unreasonable. And where the inquiry is as to the fair value of the property, in order to determine the reasonableness of the return allowed by the rate-making power, it is not admissible to attribute to the property owned by the carriers a speculative increment of value, over the amount invested in it and beyond the value of similar property owned by others, solely by reason of the fact that it is used in the public service. That would be to disregard the essential conditions of the public use, and to make the public use destructive of the public right.

The increase sought for "railway value" in these cases is an increment over all outlays of the carrier and over the values of similar land in the vicinity. It is an increment which cannot be referred to any known criterion, but must rest on a mere expression of judgment which finds no proper test or standard in the transactions of the business world. It is an increment which in the last analysis must rest on an estimate of the value of the railroad use as compared with other business uses; it involves an appreciation of the returns from rates (when rates themselves are in dispute) and a sweeping generalization embracing substantially all the activities of the community. For an allowance of this character there is no warrant.

Assuming that the company is entitled to a reasonable share in the general prosperity of the communities which it serves, and thus to attribute to its property an increase in value, still the increase so allowed, apart from any improvements it may make, cannot properly extend beyond the fair average of the normal market value of land in the vicinity having a similar character. Otherwise we enter the realm of mere conjecture. We therefore hold that it was error to base the estimates of value of the right-of-way, yards and terminals upon the so-called "railway value" of the property. The company would certainly have no ground of complaint if it were allowed a value for these lands equal to the fair average market value of similar land in the vicinity, without additions by the use of multipliers, or otherwise, to cover hypothetical outlays. The allowances made below for a conjectural cost of acquisition and consequential damages must be disapproved; and, in this view, we also think it was error to add to the amount taken as the present value of the lands the further sums, calculated on that value, which were embraced in the items of "engineering, superintendence, legal expenses," "contingencies" and "interest during construction."

By reason of the nature of the estimates, and the points to which the testimony was addressed, the amount of the fair value of the company's land cannot be satisfactorily determined from the evidence, but it sufficiently appears for the reasons we have stated that the amounts found were largely excessive.

Finding this defect in the proof, it is not necessary to consider the objections which relate to the sources from which the property was derived or its mode of acquisition, or those which are urged to the inclusion of certain lands which it is said were not actually used as a part of the plant; and we express no opinion upon the merits of these contentions.

The property other than land, as the detailed statement shows, embraced all items of construction, including road-bed, bridges, tunnels, etc., structures of every sort, and all appliances and equipment. The cost of reproduction new was ascertained by reference to the prices for such work and property. In view of the range of the questions we have been called upon to consider, we shall not extend this opinion for the purpose of reviewing this estimate, or of passing upon exceptions to various items in it, as their disposition would not affect the result.

The Master allowed the cost of reproduction new without deduction for depreciation. It was not denied that there was depreciation in fact. As the Master said, "everything on and above the road-bed depreciates from wear and weather stress. The life of a tie is from eight to ten years only. Structures become antiquated, inadequate and more or less dilapidated. Ballast requires renewal, tools and machinery wear out, cars, locomotives and equipment, as time goes on, are worn out or discarded for newer types." But it was found that this depreciation was more than offset by appreciation; that "the road-bed was constantly increasing in value"; that it "becomes solidified, embankments and slopes or excavations become settled and stable and so the better resist the effects of rains and frost"; that it "becomes adjusted to surface drainage, and the adjustment is made permanent by concrete structures and rip-rap"; and that in other ways, a road-bed long in use "is far more valuable than one newly constructed." It was said that "a large part of the depreciation is taken care of by constant repairs, renewals, additions and replacements, a sufficient sum being annually set aside and devoted to this purpose, so that this, with the application of road-bed and adaptation to the needs of the country and of the public served, together with working capital . . . fully offsets all depreciation and renders the physical properties of the road not less valuable than their cost of reproduction new." And in a further statement upon the point, the "knowledge derived from experience" and "readiness to serve" were mentioned as additional offsets.

We cannot approve this disposition of the matter of depreciation. It appears that the Master allowed, in the cost of reproduction, the sum of $1,613,612 for adaptation and solidification of road-bed, this being included in the item of grading and being the estimate of the engineer of the state commission of the proper amount to be allowed. It is also to be noted that the depreciation in question is not that which has been overcome by repairs and replacements, but is the actual existing depreciation in the plant as compared with the new one. It would seem to be inevitable that in many parts of the plant there should be such depreciation, as for example in old structures and equipment remaining on hand. And when an estimate of value is made on the basis of reproduction new, the extent of

existing depreciation should be shown and deducted. This apparently was done in the statement submitted by this company to the Interstate Commerce Commission in the Spokane Rate case in connection with an estimate of the cost of reproduction of the entire system as of March, 1907. (See 15 I. C. C. 395, 396.) In the present case, it appears that the engineer of the state commission estimated the depreciation in the property at between eight and nine million dollars. If there are items entering into the estimate of cost which should be credited with appreciation, this also should appear, so that instead of a broad comparison there should be specific findings showing the items which enter into the account of physical valuation on both sides.

It must be remembered that we are concerned with a charge of confiscation of property by the denial of a fair return for its use; and to determine the truth of the charge there is sought to be ascertained the present value of the property. The realization of the benefits of property must always depend in large degree on the ability and sagacity of those who employ it, but the appraisement is of an instrument of public service, as property, not of the skill of the users. And when particular physical items are estimated as worth so much new, if in fact they be depreciated, this amount should be found and allowed for. If this is not done, the physical valuation is manifestly incomplete. And it must be regarded as incomplete in this case.

Apportionment of Values. As the rate of net return from the entire Minnesota business (interstate and intrastate) during the test year was 6.021 per cent. on a valuation of $90,204,545, and would be greater if computed upon a less value, we are brought to the question whether the methods of apportionment adopted are so clearly appropriate and accurate as to require a finding of confiscation of property used in the intrastate business.

The apportionment of the value of the property, as found, between the interstate and intrastate business was made upon the basis of the gross revenue derived from each. This is a simple method, easily applied, and for that reason has been repeatedly used. It has not, however, been approved by this court and its correctness is now challenged. Doubtless, there may be cases where the facts would show confiscation so convincingly in any event, after full allowance for possible errors in computation, as to make negligible questions arising from the use of particular methods. But this case is not of that character.

In support of this method, it is said that a division of the value of the property according to gross earnings is a division according to the "value of the use," and therefore proper. But it would seem to be clear that the value of the use is not shown by *gross* earnings. The gross earnings may be consumed by expenses, leaving little or no profit. If, for example, the intrastate rates were so far reduced as to leave no net profits, and the only profitable business was the interstate business, it certainly could not be said that the value of the use was measured by the gross revenue.

It is not asserted that the relation of expense to revenue is the same in both businesses; on the contrary, it is insisted that it is widely different. The Master found that the revenue per ton-mile in the intrastate business, as compared with the revenue per ton-mile in the interstate business, was as 1.4387 to 1.0000. And, on his assumption as to the extra cost of doing the intrastate business, he reached the conclusion that the cost per ton-mile in proportion to the revenue per ton-mile in the intrastate business, as compared with the interstate business, was as 1.7377 to 1.0000. It is contended, according to the computations, that only a little over 10 per cent. of the entire net revenue of the test year ($5,431,514.66) was made in the intrastate business, and that 90 per cent. thereof was made in the interstate business; but approximately 21 per cent. of the total value of the property was assigned to the intrastate business.

If the property is to be divided according to the value of the use, it is plain that the gross-earnings method is not an accurate measure of that value.

The value of the use, as measured by return, cannot be made the criterion when the return itself is in question. If the return, as formerly allowed, be taken as the basis, then the validity of the state's reduction would have to be tested by the very rates which the state denounced as exorbitant. And, if the return as permitted under the new rates be taken, then the state's action itself reduces the amount of value upon which the fairness of the return is to be computed.

When rates are in controversy, it would seem to be necessary to find a basis for a division of the total value of the property independently of revenue, and this must be found in the use that is made of the property. That is, there should be assigned to each business that proportion of the total value of the property which will correspond to the extent of its employment in that business. It is said that this is extremely difficult; in particular, because of the necessity for making a division between the passenger and freight business and the obvious lack of correspondence between ton-miles and passenger-miles. It does not appear, however, that these are the only units available for such a division; and it would seem that, after assigning to the passenger and freight departments respectively, the property exclusively used in each, comparable use-units might be found which would afford the basis for a reasonable division with respect to property used in common. It is suggested that other methods of calculation would be equally unfavorable to the state rates, but this we cannot assume.

It is sufficient to say that the method here adopted is not of a character to justify the court in basing upon it a finding that the rates are confiscatory.

RAILWAY SIGNAL ASSOCIATION.

The June meeting of this association was held in New York City beginning June 11 and 12, with President B. H. Mann in the chair. Mr. Mann mentioned the work being carried on in connection with committees of other associations and heartily recommended the joint committee work. Mr. Anthony spoke of the work being done in connection with the superintendents of telegraph regarding the joint use of pole lines. Mention was also made of the necessity of making early hotel reservations for the annual convention at Nashville. Mr. Rosenberg will issue a circular in regard to this matter.

In the entertainment which was furnished by the Signal Appliance Association Wednesday afternoon—a boat trip around the city, landing at Coney Island for dinner—moving pictures were taken as the members and guests boarded the steamer.

The first business was the report of Committee No. 2, submitted by C. J. Kelloway, chairman. A long discussion followed on R. S. A. drawing No. 1260, mechanical single switch layout with one facing point lock and one detector bar. W. H. Elliot suggested that the plans be discussed as information but not as standards, stating that there was an unnecessary duplication of parts. Mr. Rudd suggested that a note be added stating that certain parts shown have not yet been standardized. Mr. Mock suggested that the committee observe page 212 of the *Journal* of the Association for June, as a guide in showing dimensions. A disagreement arose concerning the duties of Committees 2 and 6, and it was suggested that the committee submit new plans at the Nashville Convention, accepting the suggestions offered. This was put to vote and carried. The other drawings submitted by this committee were then discussed, suggestions being made for guidance of the committee.

The report of Committee No. 3 was submitted by R. C. Johnson. The specifications for the installation of a vitrified clay conduit system were read and slight changes made in the wording. C. E. Denney moved that the specifications for construction be compiled separately from those for material. This motion was carried. It was then voted that the specifications as corrected be accepted for presentation at the annual convention. The recommendation shown on page 138 will be presented to the annual convention as printed.

The report of Committee No. 4 was presented by A. R. Fugina

in the absence of Messrs. Adams and Phinney. In Section 5 of the specifications for relays the word "water" was substituted for "moisture." The suggestion was made that the specifications for lifting armature, neutral type D. C. interlocking relays be corrected to conform to the present methods of manufacture and that representatives of the supply houses be consulted in preparing these specifications for the annual convention. This suggestion was accepted by the committee. The report of Sub-committee No. 12, of Committee No. 4, was presented by Mr. Fugina. T. S. Stevens said that paragraph b, of part 2, of the specifications for vibrating crossing alarms, was unnecessary; but after it was shown that four roads needed this clause the paragraph was accepted as a part of the specifications. Mr. McCready, of the Union Switch & Signal Company, suggested that the committee look into the working resistance of crossing bells. This was put in the form of a motion and carried. Mr. McCready moved that, "Normal Working Voltage" be inserted under part 16, and this was carried. Mr. Elliot moved that the word "Alarm" be stricken from the title. This motion was carried. Mr. Stevens moved that paragraphs b and c of part 2 be reconsidered, on account of the practices of the various roads. This motion was carried and the committee was then excused.

The report of Committee No. 5 was presented by T. S. Stevens. C. C. Anthony suggested that where the word "operator" appears the word "signalman" be substituted. Mr. Rudd suggested that part 2-b of the paragraph on Controlled Manual Block be reconsidered and be changed so as to provide for a broken train. These suggestions were accepted by the committee. Mr. Stevens then explained that the drawings shown were so arranged that the cost of any combination might be easily estimated. Mr. Denney suggested that a note to that effect be added to parts m. b. 1 and m. b. 2. Mr. Elliot suggested showing a bill of material and Mr. Morrison recommended the insertion of a note stating that R. S. A. Standards be used where possible. In part m. b. 1, paragraph d, and m. b. 2, paragraph c, the word "Arranged" was substituted for "Complete." The word "Written" was removed from paragraphs d and f of part m. b. 1, and paragraph c of m. b. 2.

The report of Committee No. 6 was presented by J. C. Mock. Drawings 1008, 1009, 1085, 1099 and 1063, were accepted. In drawing 1084 the dimension of ⅛ in. was inserted to show the thickness of web, in accordance with a suggestion by Mr. McCready. Drawing 1095 was accepted with the proviso that the committee arrange for a removable cap. Mr. Stevens moved that a multiple unit bolt lock be designed, and Mr. Anthony moved that an adjustable unit bolt lock be designed. These motions were carried and the committee instructed to so proceed. The color of blades was discussed and the committee instructed to send circular letters to get information as to whether a combination of red and white or yellow and black is preferred. The committee reported that designs for lamp brackets and for bridges are being considered.

The report of Committee No. 8 was presented by H. S. Balliet. Regarding paragraph 602 on page 161 the committee accepted a suggestion that the part referring to contracts read "front and back contacts shall carry four amperes and break 10 amperes." In paragraph 545 the words "Core type" were taken out. The specifications for A. C. and D. C. Core Type Impedance Bonds were accepted. The other specifications presented by this committee were read and accepted, Mr. Balliet recommending that they be carefully studied before the annual convention.

The report of Committee No. 9 was presented by Mr. Elliott as information. He stated that about one-half of the users of the R. S. A. formula for insulation found it satisfactory. There was a short discussion by Messrs. Rudd, Stevens, Wilson and Martin, and the committee was excused.

The report of Committee No. 10 was presented by R. B. Elsworth. The report of the committee was accepted after a long discussion on paragraphs a. and c. of part 5. It was finally carried that the word "Pure" be inserted before "Lead" in the title.

J. E. Saunders was highly complimented on the presentation of his papers, and particularly by Messrs. Morrison, Waldron, Stevens and McCready. Mr. Leisenring suggested the addition of a note stating that the papers applied chiefly to steam roads practice. This suggestion was accepted. The discussion and a notice of the papers will appear in the *Journal* of the Association for September.

HEATING SMALL STATIONS.

By D. E. Lamon.*

After carrying coal and keeping fires going in a set of three stoves in my station for ten years I have come to the conclusion that from about every possible point of view, the use of stoves for heating the ordinary station of two waiting rooms and an office is a failure.

If a small basement were made under the building just large enough for a furnace, a coal bin, and an ash heap, with a coal chute from the platform and a window in the rear for getting the ashes out, the plan would prove decidedly better. If a furnace, made upon the plan of the present stove, solid and substantial but cheap, were to be installed, the first cost would not be a great deal more than the cost of the three stoves with their pipes and chimneys, and this difference would be quickly made up in the fuel saved.

Not so much coal would be burned; not so much time required to keep the fire going; less fire risk from one chimney than from two; no ashes on the floor, and less smoke and soot on the walls. The rooms would have a more up to date appearance, space in the office and waiting rooms would be saved, and the comfort of passengers and efficiency of the service would be increased.

Three separate fires for the three rooms are too many. They burn too much coal, and in many cases employees will not keep them up properly. If the fire in the office is going all right and they are comfortable, they do not worry about the waiting rooms. I have noticed this at many offices, more especially at night when the agent is not on duty to see how things are attended to. Many times, too, during the daytime, when the agent or man on duty is very busy he unintentionally overlooks the fact that the fire in the waiting room is getting low until it is out; and usually about that time someone leaves the outside door open and the room becomes cold in a very short time, giving just cause for complaint. If the fire that kept the office warm also warmed the waiting rooms he would not forget it.

The station stove is an old offender in the way of throwing out dirt. It is almost impossible to avoid having more or less ashes and coal dust on the floors. It is also out of the question to keep stoves properly blacked, as the polish will burn off in two or three days; and at their best they are not an ornament. The introduction of the furnace would do away with all of this dirt, and would give passengers the impression that the road was trying to keep up to date.

This plan could not be used at a station situated on ground so low that the basement would be flooded during rainy weather but I believe that the majority of stations are built at places where flooding could be avoided.

Sunday Trains in Scotland.—An influential deputation of Scottish religious bodies waited upon the Caledonian Railway board of directors to press home the public outcry against the Sunday railway service which is to be inaugurated immediately. Sir Charles Renshaw, refusing the prayer of the petition, said the Scottish railways had not by any means moved rapidly in the direction of developing Sunday traveling. The public demanded it, and, as Glasgow cars had long since given these facilities and citizens had not objected, there was no reason why railways should not share in the traffic.

*Agent of the Chicago & North Western, Three Lakes, Wis.

SUPERHEATING AND FEED WATER HEATING.*

Theoretical Discussion of These Features in Various Combinations Checked by Results on Egyptian State Railways.

By F. H. Trevithick and P. J. Cowan.

The tendency in recent years to increase trainloads and average speeds has, in the main, resulted in larger locomotives. By putting proportionately more weight into the boiler, the evaporative capacity has been increased, and, since boiler capacity limits the tractive effort at anything above low speeds, this has been quite a logical development. The same provision, at equal loads, results in increased economy, since the rate

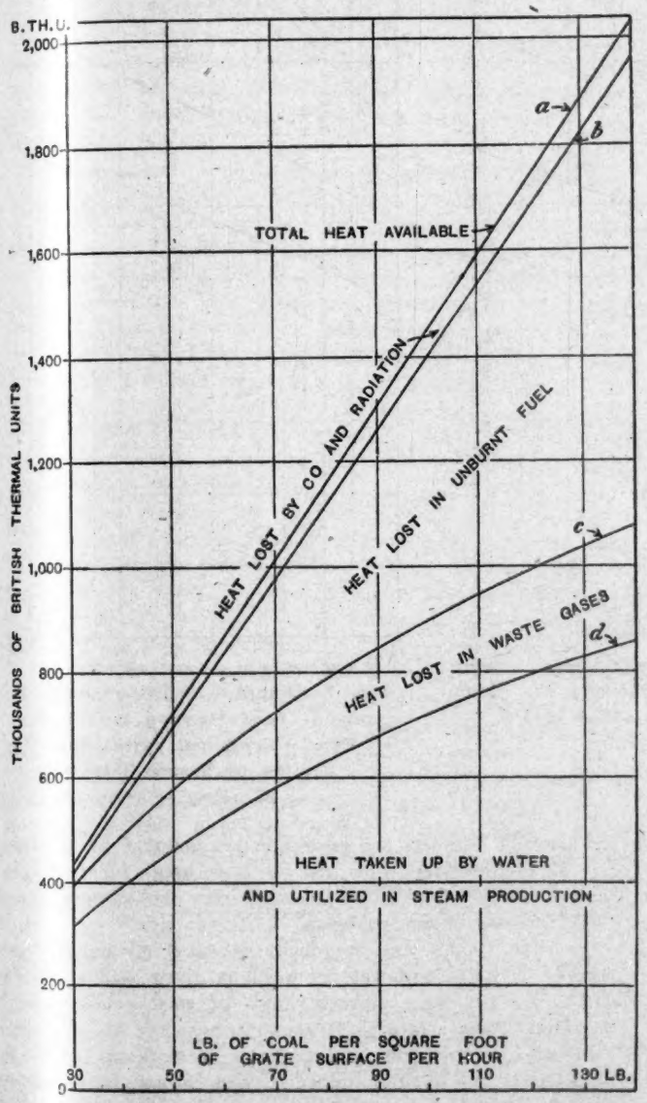


Fig. 1—Heat Utilized and Lost at Different Rates of Firing, Based on the St. Louis Tests (Series 200).

of firing is brought down to a point where the boiler efficiency is greater.

Fig. 1 shows the nature of the losses of heat in steam production in the form of a diagram of heat available, taking 14,500 B. t. u. as a typical calorific value for the coal. The line a represents the total heat available in the fuel at any rate of firing per square foot of grate area per hour. This diagram is merely typical. A comparison of numerous published results shows that it may fairly be taken to be so.

*Abstract of a paper presented before the Institution of Mechanical Engineers (London), March 14, 1913.

In locomotive operation, engine output, steam output, rate of firing, draft, smokebox temperature and other factors are interdependent. Engine output for a large part of the range of working is limited by boiler output, which is dependent upon the rate of firing. This, in its turn, depends on draft,

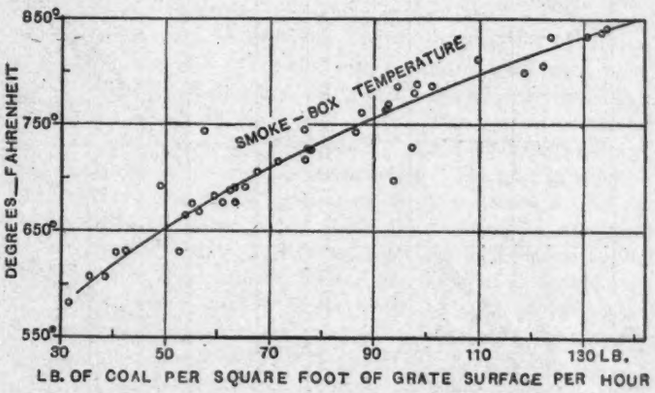


Fig. 2—Relation of Smokebox Temperature to Rate of Firing.†

which, other conditions being unaltered, is a function of the steam exhausted. The vacuum in front of the diaphragm in American engines is often twice as intense as that behind it.

The net loss of heat in the waste gases is dependent upon their quantity and specific heat and the smokebox temperature. In quantity the waste gases increase with the rate of firing, though the amount of gas per pound of fuel burned tends to diminish. The manner in which smokebox temperatures increase with the rate of firing is shown in Fig. 2. The St. Louis tests on modern large boilered engines show lower temperatures than the Purdue tests represented in Fig. 2. The specific

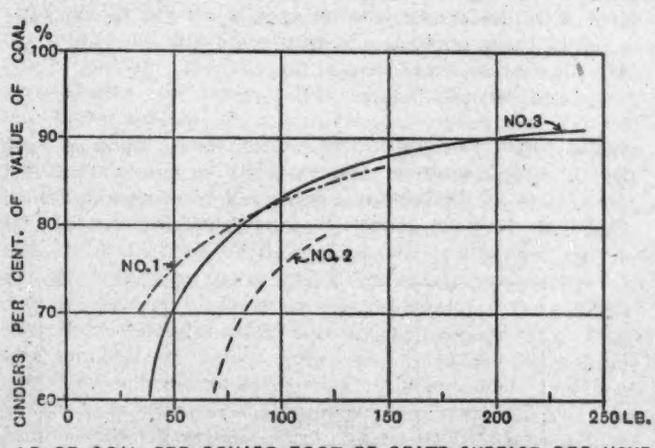


Fig. 3—Relation of Calorific Value of Cinders Passing Through the Boiler Tubes to Rate of Firing.‡

heat of the waste gases increases with smokebox temperatures. As a net result of the combination of these three factors, the proportion of the loss in the waste gases to the heat available in the coal gradually falls, but in amount increases with the rate of firing.

†Values are from Goss' "High Steam Pressures in Locomotive Service" (Youghiogheny coal).

‡Values for No. 1 are taken from Goss' "Superheated Steam in Locomotive Service" (Pocahontas coal); No. 2, for Youghiogheny coal; No. 3, from "Locomotive Sparks" (Brazil black coal).

Of the loss by unburnt fuel, part, occurring at the grate, is not usually preventable, except such as arises from inexpert firing. The larger portion of this loss is involved with rate of firing has on the relative amounts of the smokebox cinders, and those passing out of the stack, but it appears probable that so long as the smokebox capacity is not taxed,

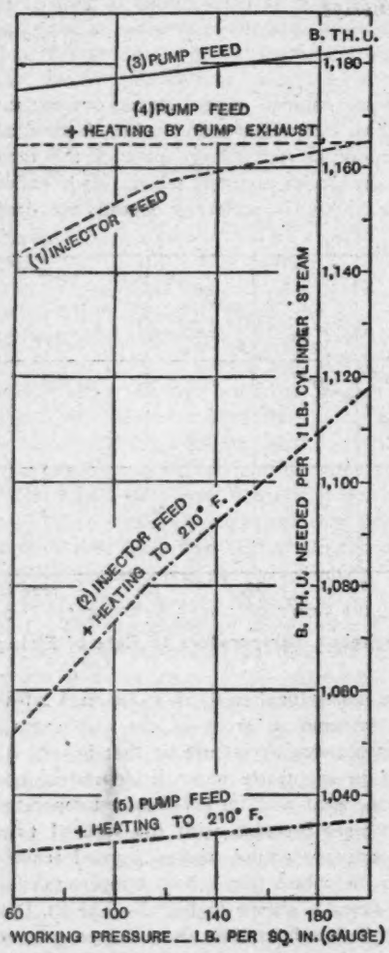


Fig. 4—Saturated Steam Boiler Output in B.t.u. Necessary with Various Conditions of Feed for Each Pound of Steam Used in the Cylinders.

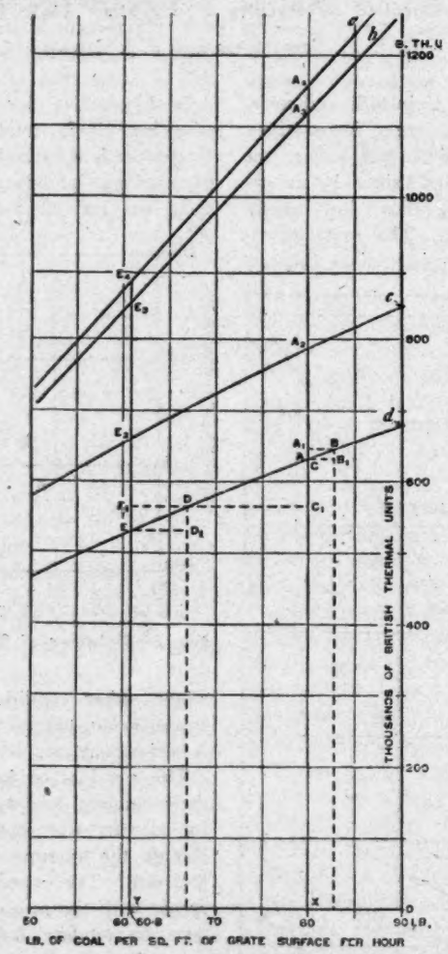


Fig. 5—Diagram Showing the Economy of Feed Heating to 270 Deg. Fahr.

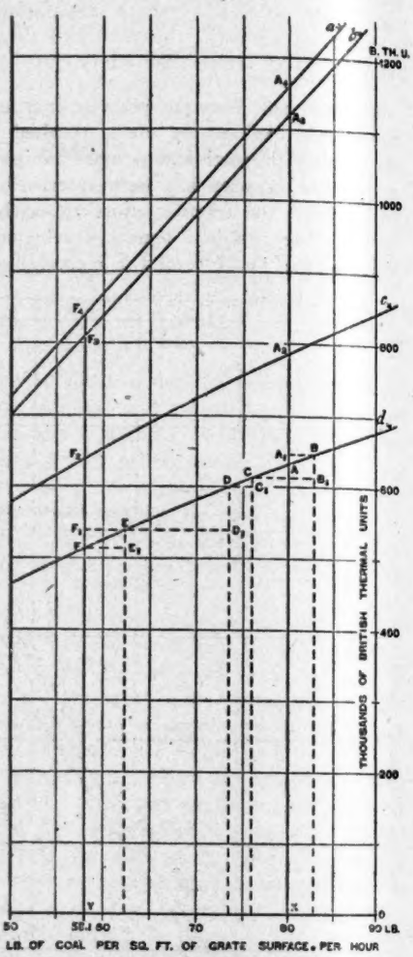


Fig. 7—Diagram Showing the Economy of Feed Heating to 210 Deg. Fahr., Combined with Superheating by Waste Gases to 85 Deg. Fahr.

engine output and draft. The greatest loss is traceable to the quality and quantity of the smokebox cinders, and of those passing out of the chimney. Both these increase with the rate of firing. It is not possible to state definitely what effect the

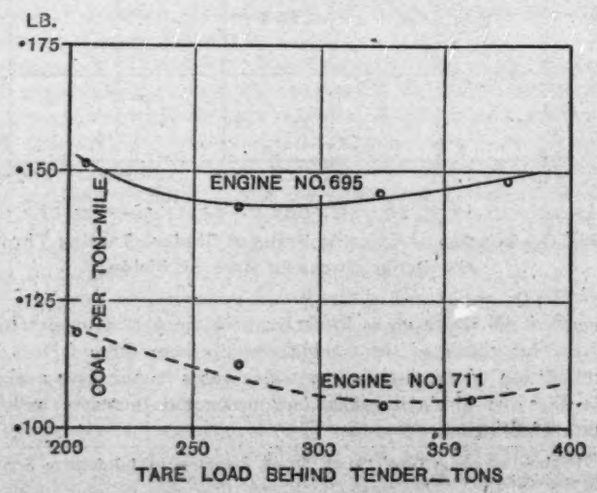


Fig. 6—Coal Consumption per Ton-Mile for Engine 711 (Feed Heating to 270 Deg. Fahr.) and Engine 695 (Non-Heater).

the smokebox cinders are greater in amount than those passing out of the chimney when the work is light, and that when the engine is forced, those emitted from the chimney exceed those retained in the smokebox.

An idea of the way in which the calorific value of these cinders increases with rate of firing is given by Fig. 3. The curves are for three different kinds of coal. Their value is thus high, being shown to be about 90 per cent. of the original value of the coal at the highest rates of working. In the St. Louis tests the highest calorific value found for smokebox cinders was 95 per cent. of the value of the original coal, and for the cinders ejected 87.6 per cent. of the coal value. The average for all tests was for smokebox cinders 80.7 per cent., and for cinders ejected through the chimney 72.5 per cent. of the original value of the coal.

The facts which show so rapid an increase in the boiler losses at the higher rates of firing emphasize the statement already made that improvement will be realized if the necessary output can by some means be secured at a reduced rate of firing. Two processes which meet this requirement are feed-water heating and steam superheating.

FEED WATER HEATING.

For feed-heating agents, providing a direct saving of otherwise waste heat, there are available the exhaust steam and the

waste gases passing out of the chimney. If these agents are used in series, heating by the waste gases must be accomplished last. As the process may be arranged to result in temperatures being reached at which even the so-called hot water injectors will not work, its successful adoption involves a reconsideration of the feeding system generally.

The ordinary injector will not pick up water above about 120 deg. to 125 deg. F., and the feed water cannot, therefore, be effectively heated before it reaches the injector, while the admixture in that apparatus of live steam with the feed, so raises the temperature of the latter that full advantage cannot be taken of subsequent heating by either of the agents available. An injector may feed into a boiler at 180 lbs. about 11.2 lbs. of water for every pound of steam used. If the supply be at 65 deg. F. the delivery will be about 160.5 deg. F. This increase is not an economic gain. Delivery falls off as the boiler pressure rises, and the temperature of delivery is higher at the higher pressures. Subsequent feed heating is of less advantage now than it would have been when pressures were lower.

For each pound of steam used in the cylinders (1 + a fraction) must be produced in the boiler, from the temperature of the injector discharge, in order to supply both the engine and injector. The B. t. u. thus to be produced are given for various pressures in Fig. 4, by curve 1, which is based on data published by S. L. Kneass.* If, subsequent to delivery from the injector, the feed be heated by the cylinder exhaust to 210 deg. F., the boiler work is reduced, as denoted by curve 2. The work needed increases with the boiler pressure. Heat can further be transmitted from the waste gases, and an average feed temperature of 280 deg. to 290 deg. F. obtained, but compensation can in no way be secured for heating during part of the process with live steam.

At modern pressures the ordinary exhaust injector shows a thermal saving over the live steam injector of some 9 per cent. The supplementary portion of the exhaust injector is handicapped by the water fed to it being already at a high temperature (about 180 deg. F.). Its steam consumption is thus high, and the final temperature of discharge is about 280 deg. F. Additional feed heating is thus impracticable, even by the waste gases. The only gain procurable with this injector is that due to the use of part of the exhaust steam; this, however, may exceed the thermal gain of 9 per cent. or so. In a more recent form of exhaust steam injector the efficiency of the exhaust steam jet has been improved, and much less supplementary live steam is needed. Though the thermal position is the same with both types, the discharge temperature is thus lower with the later pattern. The final temperature with the later type is 195 deg. F. compared with 280 deg. F. with the earlier, and further feed heating is practicable.

The pump offers advantages over the injector in connection with feed heating, since, with it, the feed temperature is not increased in the process of raising the pressure, and the temperature head is sufficient for the effective transfer of heat to the pump delivery, successively from the exhaust steam and the waste gases. On account of the sudden demands which a locomotive feed pump is called upon to meet, such an appliance should be arranged to work with water at moderately low temperatures, and the greater part of the feed heating process should be carried out between the pump and the boiler check valve.

Independent steam pumps suitable for locomotive work will deliver 100 lbs. of water for about 1.5 lbs. of steam, working at and against 180 lbs. pressure. Curve 3, Fig. 4, shows the B. t. u to be provided by the boiler for each 1 lb. of steam delivered to the cylinders, using pump supply and feed at 65 deg. F. Curve 4 shows the work required if the pump exhaust be utilized for feed heating, about the same amount being required at all pressures. The pump and injector are then on an equal footing at modern pressures. Heating, further, by the main cylinder exhaust to 210 deg. F., reduces the boiler work to the amounts shown by curve 5. This system has a considerable advantage over the injector feed combined with heating to 210 deg. F. (see curve 2), and this is maintained if the feed heating be carried still further.

*"Practice and Theory of the Injector." (Wiley.)

SUPERHEATING.

In superheating, a final benefit may be due to different causes according to the system. In one system the heat in the waste gases discharged from the boiler is utilized to raise the temperature of the steam. In another a directly fired superheater is employed, commonly incorporated for convenience in the boiler, in order that one grate may serve both.

Contrary to general experience in other branches of steam engineering, and also in conflict with testimony from many railways, it has been maintained that waste-gas superheating effects little or no benefit in locomotive work. This system combines improvements in two directions, namely, in the efficiency of steam generation and in the engine's consumption. The gain in generation has been commonly ignored or actually denied so far as locomotive work is concerned, while the engine gain has been fairly generally admitted. A true waste-gas superheater forms an adjunct to the ordinary boiler. Its installation should not disturb the heating capacity of the boiler, nor altar its efficiency. The over-all efficiency of the generator is improved, the proportion of heat available in the coal, put to use, being increased.

Directly fired superheater locomotives, using superheat from 100 deg. F. upwards, which can lay claim to no improvement in the efficiency of steam generation, but rather suffer in an adverse sense, admittedly prove satisfactory in service. There appears, therefore, to be no valid reason why the waste-gas heating system, with which superheat of about 90 deg. F. can be obtained, should not likewise give good results. The difference between the temperatures just cited is more than made up by the higher over-all efficiency of the combined waste-gas heater and boiler.

It is difficult to determine the economical position of the directly fired superheater installations of the moderate degree or high degree types, as applied in locomotive service. For the generator efficiency to be undiminished, no more heat must be lost from a superheater boiler than in the ordinary boiler. In some installations the average amount of heat absorbed through the smoke-tube superheater surface may about equal, as far as can be gathered, the average amount transmitted through the water-heating tube-surface. This may be so in the double-loop high-degree type in which high steam velocities are used, and the ends of the loops are brought fairly near the firebox. Locally, transmission is then very great and the average is high. With the single-loop types giving moderate degrees of superheat, the elements are often short and the speeds low. The transmission, at the best, is then comparatively low, and, on the average, lower than that of the water-heating tube surface. As regards efficiency of steam generation, therefore, the combination of the waste-gas superheater and boiler ranks first. Probably the ordinary boiler ranks second and the high degree smoke-tube superheater boiler third, but this does not appear yet to have been definitely determined; it is possible their relative positions are not the same at all powers. Last of all stands the moderate degree smoke-tube superheater boiler.

Though the above aspect of superheating is often treated with indifference, it is generally conceded that there is more or less saving in steam at all degrees of superheat. Even with no superheat the use of a heater may reduce the feed necessary, if the steam normally sent over is wet. Part of the economy shown on road tests undoubtedly arises from this. With any temperature above that corresponding to dry steam, there is an improvement in the engine. This has been determined in road tests, and also on testing plants. Dr. Goss and others responsible for the work at Purdue University have concluded that steam consumption falls with increasing superheat. This determination is naturally only approximate. The data issued from Purdue con-

stitute the only records yet published, showing the effect of progressive superheat on steam consumption in locomotive service. As regards coal consumption, however, they do not fairly indicate the possibilities of moderate superheating (though it is sometimes held they do), since they do not embrace investigations with the more efficient installations of that class.

COAL CONSUMPTION.

Feed-water heating and superheating may be employed in various arrangements or combinations. For moderate feed-heating, the pump exhaust and part of the main cylinder exhaust are used. The former raises the feed temperature by 25 deg. to 30 deg. F., the latter to about 210 deg. F., or slightly more. High degrees may be attained by continuing the process with a smoke-box heater in series. Temperatures of 280 deg. to 290 deg. F. may thus be reached, with even 360 deg. F. for short supplies feeding to a boiler working at a pressure of 180 lb. The smoke-box heater may be used alternatively for moderate superheating, when a superheat of about 90 deg. F. may be secured. Thus feed-heating to 210 deg. F. and moderate waste-gas superheating may be combined. Finally, with the smoke-tube type of superheater, moderate and high degree feed-water heating may also be adopted.

High Degree Feed-Water Heating.—Unless conditions are unfavorable, feed-heating is purely a gain to the boiler. If an engine be overrated, hot feed may be accompanied by the production of somewhat drier steam. The effect of feed-heating may be studied by the aid of Fig. 5, which is part of Fig. 1 to an enlarged scale.

Taking, as typical, a rate of firing of 80 lbs. per square foot of grate area per hour, by the scale, AX, the amount of heat utilized in steam production is 632,000 B. t. u. This is equivalent to the evaporation of 591 lbs. of water from and at 160.5 deg. F., the temperature of discharge of the injector with supply at 65 deg. F. and boiler pressure at 180 lbs. Dividing this in the proportion of 11.2 to 1, gives 542.57 lbs. as the steam taken by the engine, and 48.44 lbs. as that used in working the injector. For a pump-fed engine (with supply at 65 deg. F.) to develop the same power, the same number of pounds of steam must be furnished to the cylinders. This requires 542.57 (1197.7 — 33.07) = 631,890 B. t. u., 1197.7 representing the total heat in steam at 180 lbs. pressure, and 33.07 that in the water at 65 deg. F., both above 32 deg. F. The pump consumption will be taken as 2.2 lbs. of steam per 100 lbs. of water delivered, and therefore (542.57 × .022) lbs. = 11.94 lbs. of steam are needed for the pump, equivalent to a demand on the boiler of 13,910 B. t. u. The total number of thermal units to be generated is thus (631,890 + 13,910) = 645,800 B. t. u. This is supplied in stages, namely, by the pump exhaust heating by 25 deg. F., or to 90 deg. F.; by the main cylinder exhaust to 210 deg. F.; by the waste-gas heater to, say, 270 deg. F. (a temperature easily reached); and finally by the boiler. The total heat supplied per 1 lb. of steam is (1197.7 — 33.07) = 1164.63 B. t. u. Of this, therefore, the pump exhaust furnishes (58.0 — 33.07) = 24.93 B. t. u.; the main exhaust (177.99 — 58.0) = 119.99 B. t. u.; the waste gases supply (238.8 — 177.99) = 60.81 B. t. u.; and the boiler furnishes (1197.7 — 238.8) = 958.9 B. t. u. The total heat is supplied to the engine and pump as follows:

Table I.—Heat Supplied When Feed-Heating to 270 Deg. F.

Source of Heat.	Proportion of total supplied.	B. t. u. supplied—To Engine.	To Pump.	To Engine and Pump.
Pump exhaust-heater	24.93 / 1164.63	13,530	300	13,830
Main cylinder exhaust-heaters.	119.99 / 1164.63	65,100	1,430	66,530
Waste-gas heater	60.81 / 1164.63	32,990	730	33,720
Boiler	958.9 / 1164.63	520,270	11,450	531,720
Totals		631,890	13,190	645,800

Instead of 632,000 B. t. u. to be supplied by the boiler in the injector-fed engine, coal has now only to be burnt to furnish the reduced supply of 531,720 B. t. u. Following this out in Fig. 5, the requirements have first to be increased from A to A_1 (= 645,800 B. t. u.), on account of the substitution of the pump for the injector. This corresponds to a point B on the curve d. The use of the pump-exhaust reduces the demand by 13,830 B. t. u., namely to B, and C, or slightly below the original point for the injector-fed engine. The main exhaust furnishes a further 66,530 B. t. u., and the demand is brought down to C_1 and D, and again of this 33,720 B. t. u. (DD_1) is derived from the waste gases, leaving EY (= 531,720 B. t. u.) to be provided by the boiler itself. The rate of firing which will produce this is 60.8 lbs. per square foot of grate area per hour, compared with the original 80; a saving of 24 per cent. is thus indicated for the system.

The diagram shows how this comes about, supposing smoke-box conditions to remain normal. The heat represented by DD_1 is drawn from the waste gases. This length may, therefore, be set up over E at EE_1. Then E_1E_2 represents the final loss in the waste gases compared with the original AA_1, that is, 96,000 B. t. u. instead of 156,000, or a reduction of 38.5 per cent. in this loss. The loss by unburnt fuel has been reduced from A_2A_1 (332,000 B. t. u.) to E_2E_1 (193,000 B. t. u.), a reduction of more than 41.5 per cent. The proportion of the heat utilized, to the total available, has been greatly increased. The savings by feed-heating are, in locomotive work, on a rather higher scale than in other branches of steam engineering.

Trials of this system were made on the Egyptian State Railways. Engine 711, with heaters, ran against a sister engine, 695, without heaters, on expresses between Cairo and Alexandria (130 miles), the fastest timing being 3 hours with two intermediate stops. The ton-miles accomplished were 1,939,847 by engine 711 and 1,926,054 by engine 695. The average coal per ton-mile worked out at 0.1116 lb. for 711, and 0.1450 lb. for 695—a saving of 23 per cent. for the heater engine. The results of the trials are shown in Fig. 6. The consumption of the non-heater engine increased much more rapidly with the loading than did that of the heater engine. The economy shown by the latter improves at the heavier loads.

The service data for engines in regular service confirm all trials made with this system. Table II gives such records for engines 711 and 677 and non-heater engines.

The large difference between 711 and sister non-heater engines is probably in part due to 711 being constantly used for investigation work, and being kept in first-class order. Coal was also most likely booked to it more carefully than it would otherwise have been. The figures for 711 with and without heaters are fairly comparable. Engine 677 is of another class. An all-round improvement in this case of 18 per cent. is shown for the heaters, but if the comparison be confined to periods of like climatic conditions (an important point when work in a country such as Egypt is being considered) this engine, fitted with heaters, showed an improvement of 20.5 per cent. over working without them.

Table II.—Service Working of Feed-Heater and Non-Heater Engines.

	Engine 711 without heaters.	Engine 711 with heaters.	29 Sister Engines without heaters.	Engine 677 with heaters.	Engine 677 without heaters.
Average load, tare behind tender	249.6	281.6	231	280	278.4
Average lbs. of coal per mile.....	41	35.9	40.2	37	45.1
Average lbs. of coal per ton-mile.	0.1643	0.1276	0.1749	0.1322	0.1622
Difference in favor of heaters on coal per ton-mile.....		0.367 lb.	0.0473 lb.		0.031 lb.
Ditto .....Per cent.		22	27		18

Considering the modified smokebox arrangement, the result shown for the trials of 711 (an economy of 23 per cent.) is in remarkably good agreement with the saving indicated by the method of Fig. 5. If part of the exhaust steam be efficiently employed in raising the feed to temperatures approaching the maximum, its utilization in this manner is productive of more economical working than its use in the blast would be, in maintaining a higher smokebox vacuum.

Moderate Degree Feed-Heating and Moderate Superheating by Waste Gases.—With supply at 65 deg. F. the pump-exhaust warms the feed to 90 deg. F., and part of the main cylinder exhaust subsequently carries it to about 210 deg. F. The waste-gas heater gives superheat of about 90 deg. F. on a boiler pressure of 180 lbs. per square inch. For the sake of moderation 85 deg. F. will be taken.

This degree of superheat reduces the steam consumption by about 9 per cent. Instead of the 542.57 lbs. necessary in the previous case, only 493.74 lbs., therefore, need to be supplied to this engine for the same work. Each pound contains, however, 1215.33 B. t. u. above 65 deg. F., and the total heat to be supplied for engine purposes is now $(493.74 \times 1215.33) = 600{,}060$ B. t. u. The pump requires $(493.74 \times 0.022) = 10.86$ lbs. of steam, which, taken from the dome, is saturated. This represents $(10.86 \times 1164.63) = 12{,}650$ B. t. u., and the total engine and pump requirements amount to 612,710 B. t. u., supplied as in Table III.

In this case coal has only to be burnt to supply the 514,560 B. t. u. demanded of the boiler (see Fig. 7). As before, the demand is first increased from A to A_1 by the adoption of the pump. From the corresponding point B on the curve d, superheating reduces the total demand to B_1 and C (612,170 B. t. u.). Thence to C_1 and D (600,130 B. t. u.) the demand is lowered by the use of the pump-exhaust, and to D_1 and E (539,590 B. t. u.) by the main exhaust heaters. The superheater completes the process by relieving the boiler of duty equal to 25,030 B. t. u., and the demand is brought down in this way to E_1 and F (514,560 B. t. u.), corresponding to a coal rate of 58.1 lbs. per square foot of grate per hour, compared with the original 80 lbs., or a saving of nearly 27.4 per cent.

TABLE III.—HEAT SUPPLIED WHEN USING MODERATE FEED-HEATING AND MODERATE SUPERHEATING.

Source of Heat.	Proportion of Total.	B. t. u. supplied—To Engine.	To Pump.	To Engine and Pump.
Pump exhaust-heater	24.93 / 1215.33	12,310		12,580
	24.93 / 1164.63		270	
Main exhaust-heaters	119.99 / 1215.33	59,240		60,540
	119.99 / 1164.63		1,300	
Boiler	1019.71 / 1215.33	503,480		514,560
	1019.71 / 1164.63		11,080	
Superheater	50.7 / 1215.33	25,030		25,030
Totals		600,060	12,650	612,710

EE_1 and FF_1 represent heat taken from the waste gases in superheating, and the loss in these gases is reduced from AA_1 (156,000 B. t. u.) to F_1F_2 (102,500 B. t. u.)—a saving of 34.3 per cent. The loss by unburnt fuel is restricted to F_2F_3 (173,000 B. t. u.) in lieu of A_2A_3 (332,000 B. t. u.)—a fall of 48 per cent.

Among others, two long series of trials of this class of installation have been conducted on the Egyptian state railways. The heaviest scheduled trains between Cairo and Alexandria, having average speeds, deducting for stops, of between 42.4 and 43.3 miles per hour, with loads usually above 330 and frequently over 400 tons tare behind the tender, were worked. The heater engine 706, five sister engines without heaters, and one engine of the same class (712, as then fitted) with a high degree superheater and piston valves, were all run in one link working with three De Glehn compounds. Coal was dealt with as before described, but the records were kept for over-all service working, and not as in the trials there alluded to, for running time only. The figures in Table IV, therefore, include lighting up, and some unavoidable light mileage, the latter, however, being negligible. In all these trials the checking of the coal was officially carried out by the stores department and by representatives of the general manager. The provision of the coal in sealed sacks effectually prevented the favoring of any engine with selected coal. On these railways the stores department is always responsible for the coal until it is actually on the tenders.

Engine 706 proved the most economical of the whole link, and showed 30.8 per cent. economy over the non-heater engines, and handled throughout the heaviest trains. It showed an economy of 20 per cent. on the De Glehn compounds. The difference between the 30 per cent. economy shown in these trials and the 27.4 per cent. deduced by means of Fig. 7 may be due to several causes. The average superheat may be nearer 90 deg. F. than the 85 deg. F. taken above, or the saving indicated by the Purdue tests may not quite coincide with the actual saving, or again the difference may be due to excessive moisture in the steam produced in the ordinary engine.

Another test is interesting, though made with a lighter class of engine, fitted with a type of installation since greatly improved upon. On light trains, with three stops only, the non-heater engines took 36.7 lbs. of coal per mile and the heater engines took 28.4 lbs. For similar trains, with thirteen stops and seven slacks, the consumptions were 42.9 lbs. and 33.5 lbs. respectively, the heater engine taking 5.1 lbs. extra per mile, but the non-heater 6.2 lbs. extra. For the heavy trains the difference is increased. For trains of 337 tons tare behind the tender, the non-heater engines took 38.4 lbs.; as against 47.1 lbs., a difference of 8.7 lbs., while the heater engines took 30.6 as against only 34.4, a difference of 3.8 lbs.

TABLE IV.—TRIALS OF MODERATE FEED-HEATING COMBINED WITH MODERATE SUPERHEATING.

Engine Nos.	697, 713, 717, 720, 721.	706.	669, 674, 675.
System.	Ordinary.	Heater.	De Glehn.
Average load tare behind tender	328.6	336	333.5
Coal consumption, average lbs. per mile	47.7	33.8	42
Economy in favor of Engine No. 706		29.2%	19.5%
Coal consumption, average lbs. per ton-mile	0.1453	0.1005	0.1261
Economy in favor of Engine No. 706		30.8%	20.25%

High Degree Feed Heating and High Degree Superheating.—Owing to the lack of sufficient data it is not proposed to go at length into calculations regarding this combination. It is not known how far the curve d, Fig. 1, agrees with the performance of a combined high-degree superheater and boiler. Further, when high-degree feed heating is combined with superheating, the superheater is reduced, but to what extent is yet uncertain. Also, superheater engines are commonly fitted with piston valves, to which part of their performance should rightly be credited, instead of the improvement being wholly imputed to the superheating system.

If, however, superheating to 200 deg. F. with feed heating to 290 deg. F. be considered, using the curve d, Fig. 1, as the basis, the following results are shown: For this superheat 21.15 per cent. steam economy will be obtained. The original 542.57 lbs. of engine steam would therefore be reduced to 427.82 lbs. and the heat needed would be $427.82\ (1{,}307\text{-}33.07) = 545{,}010$ B. t. u. The pump takes saturated steam representing $(427.82 \times 0.022 \times 1{,}164.63) = 10{,}960$ B. t. u., the total being 555,970. Subdividing this among the pump heater, the main exhaust heaters, the smokebox heater, and the superheater and boiler, it is found that 457,050 B. t. u. have to be provided by the superheater and boiler. The point on the curve d corresponding with this represents a rate of firing of 49.1 lbs. per square foot, as against 80, or a saving of 38.64 per cent. The loss in the waste gases has been reduced 57 per cent., and that by unburnt coal 75 per cent. These large savings seem to be substantiated in practice.

A smoke tube superheater, giving 200 deg. F. superheat, may not be considered to be representative of usual practice, but the figure is chosen because of the unavoidable fall of superheat already referred to. With the lessened boiler duty the intensity of draft is reduced, and as, for a wide range, superheat varies approximately as the draft, a drop on conversion is natural.

On the Egyptian state railways an engine, 712, giving about 200-220 deg. F. superheat before conversion, gave after the addition of the feed water heaters superheat of about 150 deg. F. Nevertheless the results proved very satisfactory.

Engine 712 was run against the heater engines 706 and 714, and, compared with them, with average tare loads behind the tender of 346.8 tons, showed a consumption of only 27.7 lbs. per mile or 0.0798 lb. per ton mile; this is an economy of 20.0 per cent. over the heater engines 706 and 714. In the 1911 trials engine 706 worked at exactly the same consumption as during this latter period, and the consumption of engine 712, fitted with the high degree feed and high superheat combination, may, in default of more direct means, be compared with that which the non-heater engines then showed. If running at an economical load, engine 712 would thus show an economy of 45 per cent. over sister non-heater engines.

Direct comparison being impossible on the heavy workings, engine 712 was transferred, for a short time, to a link of lighter trains handled by the non-heater engines. On these trains, however, engine 712 was underrated and was not working at its best. It averaged, for trains of 262 tons tare behind tender, 0.0952 lb. per ton mile, against the average for several non-heater engines of 0.1528 lb. on trains of 256.5 tons load, or an economy of 37.7 per cent.

ECONOMICAL FEATURES OF THE SYSTEMS.

The use, in all the heater systems here dealt with, of part of the cylinder exhaust for feed heating, is equivalent to an enlargement of the exhaust tip. The volume of steam driven through the orifice is diminished by over 12 per cent. Again, enclosing the blast in a comparatively small chamber, as in the later Egyptian state railways systems, increases the inducing action and results in comparatively high vacua with a larger nozzle than is used in the standard engine. In the latter a tip of 4½ in. is used above the netting, and produces in front of the tube space a vacuum of about 6 in. in normal working. With the high degree superheat system alone, as fitted to engine 712, it was necessary to reduce the tip from 4½ to 4⅜ in. to obtain a proper vacuum with the reduced quantity of steam then used. Since fitting the feed-heaters to this engine the blast pipe has been again enlarged to 4½ in., and as part of the exhaust is used for feed heating, it is now virtually one 4¾ in. in diameter for about 15 per cent. less steam than passes through the standard tip of the ordinary engine. The size to which this 4½ in. tip actually corresponds is thus about 5 in. in diameter. With these exhaust tips a vacuum of from 6 in. to 8 in. is obtained in the small blast chamber. This is reduced by the resistance offered by the heater tubes, and there is a vacuum in the smokebox proper of from 2 in. to 3 in. compared with 6 in. or more in the ordinary engine.

The lighter draft just considered results in less loss in unburnt fuel. The Egyptian state railways' engines show, progressively, less accumulation of cinders in the smokebox with increased economy. The reason why the heater engines show greater economy over the ordinary engines when on stopping trains than when on fast non-stop expresses, is connected with the blast and heater. The smokebox heater offers some resistance to the flow of the gases, and has the effect of damping the heavy pulsations of the blast when the engine is working at or near full gear. The fire is not lifted in the same way; the loss of coal is thus reduced.

Railway Accident in Macedonia.—On May 23 a collision occurred at a junction of the railway between Poroi and Andjista as the result of which two engines were completely ruined. The accident is said to have been due to an error either of the Bulgarian military station master at Poroi or the station master at Andjista, and it is reported that the one who was held to be responsible has been shot by order of Colonel Ivanoff, the inspector of Bulgarian Railways. Discipline in Macedonian railway service is rather abrupt.

SIX PASSENGERS KILLED AT STAMFORD.

In a rear collision of passenger trains on the New York, New Haven & Hartford at Stamford, Conn., at 5 p. m. on Thursday, June 12, six passengers were killed and eighteen injured; and the criticisms of the management of the road which filled the newspapers last October on the occasion of derailments at Westport and other places have been renewed with increased vigor.

The trains in collision were the first and second sections of westbound express No. 53. The first section had stopped to change engines, and while standing was run into by the second section at about 20 miles an hour or faster; and the rear car of the first section, a Pullman parlor car, well filled, was ripped open for more than half its length. All of the killed were in this car. The other cars of the train were not seriously damaged. The parlor car was of wood, and criticisms of the company for not introducing steel cars more rapidly were heard on every hand.

The collision was due to failure of the engineman of the second section, Charles J. Doherty, to control the speed of the train. He and his fireman were unhurt and testified before the coroner at Stamford on the 13th. Doherty said that the air brakes, when applied, failed to reduce the speed. The train consisted of a new Pacific type locomotive, No. 1338, and 8 cars. The engine weighs about 126 tons. Doherty was a spare runner and had run this train only 3 days; and until June 10 had run passenger trains altogether only about 4 days since he was promoted, which was in March, 1912. He is 33 years old, of good character, and an abstainer from liquor; has a perfect record as fireman 10 years, and spare runner about 1½ years, all on the New Haven road.

From the testimony of Doherty before the coroner and from statements of officers of the road to the newspapers we gather the following summary:

Doherty had found on a former trip (Tuesday) that the brake apparatus on the engine apparently was not in proper condition, "the brakes did not hold"; he had entered the fact on the proper book, but nobody had taken any action about it. He had mentioned this difficulty to other runners and got the reply that all of the new engines of that type had been subject to the same complaint. The road foreman had warned him that with the new engines, on account of their weight, it was necessary to apply brakes earlier than with the smaller engines. Doherty had overrun the platform at Bridgeport on Tuesday, and later on the same day, at South Norwalk, because of danger of running over a child, he had strained his back in reversing the engine, so that on Wednesday he worked only a half day. He came on duty Thursday with plasters on his back because of the strain. The fact that he had been off, sick, for half a day was not noticed by any superior or inspector. In the Stamford emergency, after it was plain that the brakes would not stop the train soon enough, he tried to reverse, but found his strength insufficient. Some difficulty with the reversing gear appears to have existed from the time the engine was put in service.

The distant signal at Stamford is about 2,100 ft. back of the home (the home was close to the standing train) and was properly observed. At this point in the hearing Doherty's testimony is not clear; the most that can be made out is that the line of the road is straight and the grade slightly descending; that he shut off steam before reaching the distant signal and that on finding the home signal against him he could not make the brakes hold; in short that the speed was not reduced soon enough. When within a few hundred feet of the standing train Doherty sanded the rails, and motioned frantically to a couple of trainmen standing on the ground near the rear car of the train ahead, to move that train forward. Doherty's train broke apart, behind the third car, a few hundred feet before striking the standing train, and the rear portion stopped 200 ft. or 300 ft. back of the leading portion.

Doherty said that another engineman, John Harmon, running the same train, had been suspended three days before for running past a stop signal at South Norwalk.

Doherty was held by the coroner on a charge of manslaughter in $5,000 bail on Friday, bail being furnished by his wife's brother, J. H. Dillon, of New Haven.

C. N. Woodward, general superintendent of the road, testifying before the coroner on Saturday, said that within the last six months 30 enginemen had been discharged for running past signals; this notwithstanding that there had been a campaign of education, in which the majority of enginemen took a lively interest, and in which the officers of the road had spent a great deal of time in talking with and educating the men. He could not explain the hard luck that apparently had visited the road.

C. F. Carroll, road foreman of engines, told the coroner that he had known Doherty for seven years; that he was a first-class engineer and a fine young man. Carroll himself instructed Doherty in running No. 1338. "I told him not to let her get away from him, as she was a new engine and pulled strong. He told me of being two minutes late one run, and I told him not to mind that, but to consider safety first of all. He also told me of his running by the signal at Bridgeport last Tuesday, and I told him why he did it."

"You mean he told you why, don't you?" the coroner asked.

"No, I told him why," replied Carroll. "I told him the reason was he came into the station like the devil and let her get away from him."

"Didn't he tell you the reason was that the air brakes weren't working right?" the coroner said. Carroll replied that Doherty did not say anything to him about the air.

Three enginemen who had had experience with No. 1338, including Harmon, who had been suspended on Monday, testified before the coroner. Harmon said that while he found the levers and especially the reverse lever hard to work, as might be expected, he did not attribute his running past the signal to that fact. He claimed that his air was all right, and that the trouble was that the distant signal was clear while the home was against him. All three of these enginemen testified that they had found no fault with the air.

On Saturday the New Haven road invited a number of men from other roads to come to New Haven to inspect the air brake equipment on engine 1338 and the cars of its train. These men are: P. J. Langan, chief air brake inspector of the Delaware, Lackawanna & Western; C. W. Martin, of the Pennsylvania Railroad; T. L. Burton, of the Westinghouse Company, and Charles E. Joy, chief inspector of the New Haven.

Mr. Dillon, Doherty's brother-in-law, who was the close companion of the engineer at the coroner's hearing said:

"Doherty came to me as soon as he could after the wreck. He was at my home when it was said he had disappeared. He wanted my advice. I took him in charge and shall remain in charge of him.

"I think that an engineer's story, free from the heart, has been told today for the first time. There was no advice that he misremember things or forget things. There was no previous rehearsing of his story. I saw that he came in contact with nobody until he faced the coroner, and that all suggestions that he 'come to the office,' of which five or more were made, were turned down."

The wrecked Pullman car, being worthless, was destroyed by fire at 11 p. m. on the 12th. The coroner complained of this and the officers of the road replied that there was nothing about the car which would be of any value as evidence concerning the cause of the deaths of passengers.

General Manager Bardo said that prior to March 1 last spare enginemen had been assigned to all trains, except limited trains, without special reference to their experience; but that since that date there is a rule that those men who have had less than one year's experience as runner shall not be assigned to through passenger trains.

On the 16th the coroner took testimony concerning the condition of the engine on the day when Doherty reported that the air brakes were not in good condition. It appears that the page in the book on which entries are made contains a printed list of questions relating to different parts of the engine. Doherty made notes against piston rods, water glass, and some other things, but against air brakes there was no entry; and the statement that the brakes were "no good" was made at the bottom of the page, under the head of "other work needed." Main reservoir pressure was given as 150, and the train line pressure as 110.

Doherty gives a somewhat different version of the conversation between himself and the road foreman which was referred to by the foreman at a previous hearing. According to Doherty the foreman recognized that the brakes on the new engines did not diminish speed satisfactorily.

Joseph J. Gash, the roundhouse man who attended to Doherty's report of engine 1338 on Tuesday, told the coroner that he had looked the brakes over and that they appeared to be all right; and he took no further action. He found that the piston and the air pump were all right and concluded that Doherty must have been mistaken in his statement that the brakes did not work satisfactorily.

The counsel for the road presented transcripts of a number of roundhouse records made at Springfield and New Haven which showed trips where engine 1338 had come in from passenger train runs and no complaint was made concerning the air brakes or other parts of the engine.

Engine No. 1338 weighs 251,500 lbs.; weight on drivers, 154,000 lbs.; weight of engine and tender, 384,100 lbs. The cylinders are 24 in. x 28 in.; diameter of driving wheels, 73 in.; boiler pressure, 200 lbs.; tractive effort, 37,558 lbs. The engine was built by the American Locomotive Company.

On Tuesday, June 17, eight experimental runs were made between Noroton and Stamford with the same train that caused the wreck—8 cars, 1 baggage car, a mail car, three day cars and three parlor cars, and the locomotive, the locomotive having been sufficiently repaired to be run. The air brake apparatus had not been injured and had not been changed since the day of the collision.

The grade of the road is slightly descending.

In the first trial the train was stopped from a speed of 64.5 miles an hour in 2,097 ft. In the second trial a reduction of 30 lbs. was made at once and the train was stopped from a speed of 55 miles an hour, in 1,994 ft. From a speed of 57.5 miles an hour with the emergency application of the brakes the train was stopped in 1,617 ft. The next run was made at 59.5 miles an hour, with a reduction of 15 lbs., followed by another of 15 lbs. The stop was made in 2,586 ft. In the next run the engineman, by order of the manager of the tests, attempted to duplicate the operations made by Doherty on the day of the collision, as narrated by him before the coroner. The speed at the time of the application of the brakes was 57 miles per hour. A 10 lb. reduction was made, then a 5 lb. reduction, and then full emergency application. The distance run was 2,567 ft., time 49.6 seconds, and the train ran about 350 ft. beyond the point where the collision occurred. We give these reports for what they are worth, but their value is questionable because of indefiniteness as to the exact location of the point where the brakes were applied, and also as to where they should be applied; that is to say, the accuracy of Doherty's narrative in that portion in which he tells where he applied the brake. Other tests are in progress as we go to press.

FLOOD DAMAGE IN NATAL.—It is estimated that the total cost of repairing the damage done to the railways in the province of Natal by the recent floods, and of effecting certain improvements with a view to reducing the possibility of similar damage occurring in future, would be $276,250, all of which will probably be charged to capital account.

THE ELECTRIFICATION OF TRUNK LINE RAILROADS.

An Estimate of the Cost, of the Saving in Operating Expenses and in Upkeep That Would Show a Profit of 6.8 Per Cent.

By Charles P. Kahler,

Electrical Engineer, Oregon Short Line.

The great objection to operating many of the large steam railroads by electric power is the extremely heavy investment necessary for the electric apparatus and equipment. The ability of the steam locomotive to handle railroad traffic in a very reliable and expeditious manner is very well known.

Very little of the past work of steam railroad electrification was done on account of the financial return expected on the money so expended. The smoke trouble with steam locomotives has been one of the most important reasons for the past progress in heavy electric railroad work. Irrespective of what caused the past heavy electric railroad work, the actual operation of large electric locomotives showed that they could in some ways handle railroad traffic more advantageously than steam locomotives. The published records of the steam and electric locomotives of the New York Central, the New York, New Haven & Hartford, and the Pennsylvania, indicate that electric locomotives are probably even more reliable in operation than steam locomotives. The published records of these roads also indicate that the quantity of fuel required to generate power in a steam-electric plant for railroad operation is much less than the fuel required by steam locomotives in the same service, and the locomotive repair expense was found to be much less on electric than on steam locomotives.

Further, as the electric locomotives do not have to take fuel and water, nor have a boiler or firebox to be cleaned out, they are nearly always ready for service, and take less time to handle trains than steam locomotives, especially on long runs. The perfection of the multiple unit control has made the number of driving units which can be controlled by one man practically unlimited, and, consequently, it is possible to make the size of electric locomotives much greater than steam locomotives with the boiler limitations.

Another important point in connection with electric operation has been brought out by the great success of the interurban electric railways. The gasolene motor car and the gas-electric motor car would probably not have been developed were it not for the trolley lines taking local passenger business away from the steam railroads.

If roads were electrically operated, the weight of the freight trains could in most cases be made much heavier than possible by steam operation, on account of the characteristic of the electric locomotive to operate overload without dangerous overheating, long enough to get over the short heavy grade sections, and on this account the ruling grade of an electrically operated railroad will seldom be as great as the ruling grade of a steam operated railroad.

Only one engine crew would be required on helper districts where more than one electric helper locomotive is used, as two or more electric locomotives can be coupled together and operated as a single unit by one man, while with steam locomotives as many engine crews will be needed as there are steam locomotives used.

The locomotive is directly responsible for from 30 to 40 per cent. of the operating expenses of a steam railroad. At a speed of 16.5 miles per hour, which is only a little greater than the usual average speed of freight trains, the tractive power of a consolidated steam freight locomotive and an electric locomotive for freight service is the same. Above this speed the steam locomotive can exert a higher tractive effort than the electric locomotive, while below this speed the electric locomotive has the higher tractive effort.

*Abstract of a paper presented before the American Institute of Electrical Engineers, New York, on May 20, 1913.

The steam locomotive can exert the tractive effort of 15,000 lbs. at the higher speeds only for short intervals, on account of the inability of the boiler to continuously supply the necessary steam. On the other hand, the electric locomotive cannot continuously exert the high tractive effort at low speeds without overheating. The maximum tractive effort which can be continuously exerted by the electric locomotive with safety is 34,600 lbs. at a speed of 16 miles per hour. Below this speed the high tractive efforts can only be secured for certain periods of time. Thus, for one hour, 45,000 lbs. tractive effort can be exerted without overheating the motors, with the speed at about 14 miles per hour.

At starting, as much as 55,000 lbs. can be exerted by the electric locomotive, while the steam locomotive can, under favorable conditions, only exert a tractive effort of about 43,000 lbs. at starting. One of the causes of the higher power of the electric freight locomotive at starting is that all its weight, 220,000 lbs., is on the drive wheels, while although the steam locomotive with loaded tender weighs 185 tons, it has only 187,000 lbs. on the drive wheels. Also the coefficient of adhesion is greater for an electric locomotive than for a steam locomotive.

DESCRIPTION OF RAILROAD CONSIDERED.

Let us consider a single-track railroad constructed through a semi-arid region, similar to many parts of the West, which contains numerous irrigated and dry farm districts. The length will be taken as 467 miles, divided into three engine districts, respectively 167, 160 and 140 miles long, from the west towards the east, and will be referred to as engine district No. 1, No. 2 and No. 3, in the order named. The curvature averages about 12 deg. of central angle per mile and the ascents and descents of grade average 18 ft. per mile. The engine terminals will be referred to as No. 1, No. 2, No. 3 and No. 4, from west to east. It will be assumed that there is a helper district 9 miles in length for westbound trains on engine district No. 1 and also one of the same length on engine district No. 2 for eastbound trains, the foot of these helper grades to be located 11 miles west of and 7 miles east of terminal No. 2, and the helper locomotives of both districts to be hostled and taken care of at terminal No. 2. The limiting grades of the three engine districts are shown in Table II.

Table 1.

	Engine districts.			
	No. 1.	No. 2.	No. 3.	Total.
Miles of main track	167.5	160	140.5	468
Miles of side track	54.5	51	50.5	156
Total main and side track	222	211	191	624
Miles curved track	35	33	32	100
Degrees of central angle per mile	12	12	12	12
Maximum curvature, deg	6	4	4	6
Ascents and descents of grade per mile, ft.	14	22	18	18
Average grade, per cent	0.14	0.21	0.17	0.17
Weight of rail per yard, lbs.	90	90	90	90

For steam equipment the through passenger trains are to be handled by Pacific type locomotives of 192 tons weight with loaded tender to handle from 5 to 14 coaches per train. The local passenger trains consist of a 110-ton locomotive with loaded tender baggage car, smoking car and day coach, all cars being of 45 tons weight. The freight trains are to be handled by consolidated locomotives of total weight with coal and water of 185 tons, and with 187,000 lbs. on the drive wheels. The local freight trains are to be handled by 130-ton locomotives.

For comparison of steam and electric operation, the above line will be considered as equipped with an 11,000-volt, single-phase, 15-cycle trolley, with 110,000-volt, 15-cycle high-tension

line to supply power to 14 substations, the power to be received into the high tension system at terminal No. 3. The local passenger trains are to consist of two electric motor cars and one trailer, the through passenger trains to be hauled by 100-ton electric locomotives. The local freight trains are to be hauled by 85-ton locomotives, which class of locomotives will also be used in switching service. The through freight trains, both expedite and drag, are to be hauled by 110-ton locomotives.

The passenger traffic consists of six through trains per day, three each way over the entire road. On engine district No. 1 there will be four local passenger trains per day, two each way, while on engine districts Nos. 2 and 3 there will only be two local passenger trains per day.

The annual freight traffic over each engine district will be assumed as follows:

Engine districts.	Tonnage of cars and contents. No. 1.	No. 2.	No. 3.
Westbound:			
Expedite freight	800,000	700,000	800,000
Drag freight	1,700,000	1,700,000	1,600,000
Local freight	200,000	.....	160,000
Eastbound:			
Expedite freight	600,000	600,000	600,000
Drag freight	1,300,000	1,300,000	1,200,000
Local freight	100,000	.....	100,000

To determine the number of freight trains necessary to handle the above traffic, the maximum tonnage which the locomotives can haul over each engine district will have to be determined. For steam operation, this can be closely computed if the ruling and starting grades are known. Also a close approximation of the maximum tonnage by electric operation can be made if the average grades and their length are known, together with the maximum grades at starting.

However, the most accurate way of determining the maximum tonnage which can be hauled by a locomotive is to draw the velocity diagram for the limiting grade sections of the engine districts. This will also give an idea of the variety of conditions for which a locomotive of a trunk line railroad is used.

The limiting points are determined by the starting grades, the helper grades and the ruling grades. In computing the hauling capacity for steam locomotives, it is usual to make 10 miles per hour the minimum speed in order to allow for weather conditions, the personal equation of the engineer, and other variable conditions. Westbound steam freight trains of 2,040 tons get down to 10 miles per hour at about mile post 152, on the helper section, and hence the helper section limits the weights of steam freight trains. The starting capacity of the steam locomotive is also nearly reached with the same tonnage. For westbound electric trains, the starting grades limit the weight to 3,350 tons. The weight of eastbound steam freight trains is limited to 2,240 tons by the ruling grade, 0.55 per cent. The starting grades also will not permit a heavier steam train. The weight of the eastbound electric freight trains (2,470 tons) is limited by the long 21-mile grade from mile post 82 to mile post 111, which averages 0.45 per cent., the maximum grade in this distance being 0.6 per cent. It is on these long grades, where the electric locomotive operates on its continuous rating, that the steam locomotive compares most favorably with the electric locomotive. But even here the steam locomotive's hauling capacity is determined by the ruling grade, 0.55 per cent., which is very short, while the hauling capacity of the electric locomotive is determined by the average grade, 0.45 per cent.

The electric locomotive can haul from 50 per cent. to 60 per cent. greater tonnage than the steam locomotive over these engine districts.

Table 3 shows the number of freight trains per year necessary to handle the freight traffic given above.

TABLE 3—NUMBER OF FREIGHT TRAINS PER YEAR.

	Steam locomotive. West.	East.	*Total.	Electric locomotive. West.	East.	*Total.
Engine Dist. No. 1:						
Expedite trains	656	442	1,312	309	318	636
Drag trains	1,149	793	2,298	656	688	1,376
Local trains	400	400	800	400	400	800
Totals	.....	.....	4,410	.....	.....	2,812
Engine Dist. No. 2:						
Expedite trains	809	741	1,618	404	335	808
Drag trains	1,417	1,300	2,834	859	727	1,718
Totals	.....	.....	4,452	.....	.....	2,526
Engine Dist. No. 3:						
Expedite trains	428	741	1,482	225	372	744
Drag trains	711	1,200	2,400	450	747	1,494
Local trains	320	320	640	320	320	640
Totals	.....	.....	4,522	.....	.....	2,878

*As it is necessary to operate the same number of trains in both directions on account of train crews and equipment, the totals, of course, are twice the greatest number of trains required in one direction.

TABLE 2.

	Limiting grades. West. Per Cent.	Length.	East. Per Cent.	Length.	Tonnage per train including locomotive. Steam oper. West.	East.	Electric oper. West.	East.
Engine Dist. No. 1:								
Maximum grades (exc. of helper grades)	0.56	600 ft.	0.6	1,300 ft.	(Momentum Grades)		.....	.....
Ruling grades (steam)	0.52	3,800 ft.	0.55	2,300 ft.	2,350	2,240	.....	.....
Maximum average grades:								
Continuous rating (electric)	0.22	21 mi.	0.45	28 mi.	.....	.....	3,680	2,470
Maximum grades at starting	0.32	.....	0.46	.....	2,650	2,240	3,350	2,780
Helper grades (3 engines):								
Maximum (momentary rating)	2.00	1,900 ft.	....	.....	2,040*	.....	3,450*	.....
Average grade (hourly rating)	1.3	8 mi.	....	.....	.....	.....	4,140*	.....
Maximum tons per train actually hauled	....	.....	....	.....	2,040	2,240	3,350	2,470
Engine Dist. No. 2:								
Maximum grades (exc. of helper grades)	0.81	3,100 ft.	1.00	3,900 ft.	1,690	1,432	(Partly Momentum)	
Ruling grades (steam)	0.81	3,100 ft.	1.00	3,900 ft.	1,690	1,432	.....	.....
Maximum average grades:							(Partly	
Continuous rating (electric)	0.3	8 mi.	0.48	28 mi.	.....	.....	Momentum)	2,370
Momentary rating (electric)	0.81	3,100 ft.	....	.....	.....	.....	2,590	.....
Maximum grades at starting	0.29	.....	0.5	.....	2,725	2,150	3,480	2,750
Helper grades (2 engines):								
Maximum (momentary rating)	....	.....	1.72	2,300 ft.	.....	1,645*	.....	2,680*
Average grade (hourly rating)	....	.....	1.11	9 mi.	.....	.....	.....	3,200*
Maximum tons per train actually hauled	....	.....	....	.....	1,690	1,432	2,590	2,370
Engine Dist. No. 3:								
Maximum grades	0.88	1,150 ft.	1.00	2.5 mi.	.....	1,432	.....	.....
Ruling grades (steam)	0.35	2 mi.	1.00	2.5 mi.	3,000	1,432	.....	.....
Maximum average grades:								
Continuous rating (electric)	....	.....	0.55	17 mi.	.....	.....	.....	2,160
Momentary rating (electric)	0.35	2 mi.	....	.....	.....	.....	4,583	.....
Maximum grades at starting	....	.....	0.7	.....	4,300	1,795	5,500	2,290
Maximum tons per train actually hauled	....	.....	....	.....	3,000	1,432	4,583	2,160

*Without weight of helper locomotives.

On all railroads the traffic at some seasons of the year is greater than at others. However, it is seldom that the passenger and freight busy seasons happen at the same time. The writer has been often surprised at how uniform the train mileage and ton mileage per mile of line is during the year. For the railroad considered, the maximum and average number of trains per day is taken as follows:

TABLE 4—NUMBER OF TRAINS PER DAY—(BOTH WAYS).

	Eng. dist. No. 1.		Eng. dist. No. 2.		Eng. dist. No. 3.	
	Average day.	Maximum day.	Average day.	Maximum day.	Average day.	Maximum day.
Steam trains:						
Passenger.....	10.0	10.0	8.0	8.0	8.0	8.0
Freight.....	12.1	16.0	12.2	17.0	12.4	18.0
Total.....	22.1	26.0	20.2	25.0	20.4	26.0
Electric trains:						
Passenger,....	10.0	10.0	8.0	8.0	8.0	8.0
Freight.....	7.7	11.0	6.9	10.0	7.9	12.0
Total.....	17.7	21.0	14.9	18.0	15.9	20.0

Table 5 shows the train mileage, ton mileage, and locomotive mileage necessary to handle the assumed traffic over the railroad considered. The locomotive mileage includes the mileage to and from trains and the switching locomotive mileage.

TABLE 5.

	Steam operation.	Electric operation.
Train miles:		
Local passenger trains	462,820	000
Local motor trains	000	462,820
Through passenger trains	1,022,730	1,022,730
Total passenger	1,485,550	1,485,550
Local freight trains	233,200	233,200
Through trains	1,858,670	953,344
Work trains	81,120	81,120
Total freight trains	2,172,990	1,267,664
Total all trains	3,658,540	2,753,214
Locomotive and motor car mileage:		
Motor car mileage	000	971,922
Passenger locomotives	1,559,828	1,073,867
Local freight locomotives	240,196	240,196
Through locomotives	1,914,430	981,944
Work train	107,624	107,624
Helper locomotives	225,474	102,111
Switching	397,000*	*397,000
Total freight, work, helper and switch....	2,884,724	1,828,875
Total locomotive mileage.....	4,444,552	2,902,742
Locomotive ton mileage:		
Motor cars	000	83,307,600
Passenger locomotives	259,638,174	107,386,700
Freight locomotives	385,395,130	129,631,480
Work train locomotives	15,067,360	9,686,160
Helper locomotives	41,712,690	8,386,510
Switching locomotives	55,880,000	35,730,000
Total freight, work, helper and switch....	498,055,180	183,434,150
Total all locomotives and motor cars.....	757,693,354	374,128,450
Ton mileage—cars and contents:		
Passenger trains	744,424,800	675,001,800
Freight trains	2,113,300,000	1,940,045,780
Work trains	40,560,000	40,560,000
Switching	158,800,000	158,800,000
Total cars and contents.....	3,057,084,800	2,814,407,580
Grand total ton miles.....	3,814,778,154	3,188,536,030

*Six miles allowed for each hour a switch engine is in service.

NUMBER OF LOCOMOTIVES REQUIRED.

An examination of the records of numerous steam railroads will disclose the fact that a steam locomotive spends a good portion of its time in the shops undergoing heavy repairs, also that a larger part of its time is spent in or near the engine houses where the boiler washing is done, the fire boxes and flues cleaned, and the light running repairs are made, etc. The records of two western steam roads show that their passenger locomotives spent respectively 21 per cent. and 17 per cent. of their time in the shops, and that the freight locomotives of the same roads were in the shop 30 per cent. and 24 per cent. of their time.

The most complete record of the actual distribution of engine service I have seen is given in Table 6, which is for a section of a railroad between 500 and 600 miles in length.

TABLE 6.

	Passenger locomotives.		Freight locomotives.	
	Per cent. of total time.	Days per year.	Per cent. of total time.	Days per year.
Time in shops	22.4	82	28.2	103
Time spare	1.4	5	2.7	10
Time in enginehouse (having running repairs done, boilers washed, fire boxes cleaned)	53.2	194	35.9	131
Time running to and from trains.....	1.6	6	1.1	4
Time in helper service	1.1	4	4.3	16
Time on road	20.3	74	....	...
Actually running	.....	..	17.1	62
Standing on sidings, taking water, etc.	....	..	10.7	39
Totals	100	365	100	365

It will be noted that each passenger locomotive was actually on the road, running or standing on sidings, only 74 days of the year, while each freight locomotive, exclusive of those used for helper service, was actually running only 62 days of the year and standing on sidings, etc., 39 days, not considering the helper locomotives.

The number of locomotives required to handle the traffic of any railroad depends of course upon the quantity of traffic, number of trains, the arrangement of the train schedule, ratio of maximum and average traffic, etc. An estimate of the number of steam locomotives required to handle the trains over the road can be made from the train sheets, and to this number will have to be added an allowance to cover time in engine house, shops, etc., as shown above in Table 6. However, the total number of steam locomotives shown in Tables 7, 8, 9 and 10, as required for operating the railroad discussed in this paper, is the same

TABLE 7—PASSENGER SERVICE.

	Steam locomotives.			Electric locomotives.		
	Per cent. of time.	Days of year.	No. of locomotives.	Per cent. of time.	Days of year.	No. of locomotives.
In shops	22.1	81	6.2	19.2	70	2.5
Spare	1.4	5	0.4	3.1	11	0.4
In enginehouse, etc.....	53.0	193	14.8	27.7	101	3.6
Running to and from trains.	1.6	6	0.5	3.8	14	0.5
In helper service.....	1.5	5	0.4	3.1	11	0.4
On road	20.4	75	5.7	43.1	158	5.6
Totals	100	365	28	100	365	13

TABLE 8—FREIGHT SERVICE.

	Steam locomotives.			Electric locomotives.		
	Per cent. of time.	Days of year.	No. of locomotives.	Per cent. of time.	Days of year.	No. of locomotives.
In shops.....	28.0	102	26.9	25.1	91	10.8
Spare	2.7	10	2.6	6.0	22	2.6
In enginehouse	35.8	131	34.4	27.9	102	12.0
Running to and from trains.	1.1	4	1.1	1.4	5	0.6
In helper service.....	4.8	17	4.6	3.5	13	1.5
Standing on sidings.....	10.6	39	10.1	13.7	50	5.9
Running on road.....	17.0	62	16.3	22.4	82	9.6
Totals	100.0	365	96.0	100.0	365	43.0

as that actually used on a western railroad where the quantity of traffic and other conditions are similar. The number of electric locomotives given was estimated from the steam figures.

TABLE 9—SWITCHING SERVICE.

	Steam locomotives.			Electric locomotives.		
	Per cent. of time.	Days of year.	No. of locomotives.	Per cent. of time.	Days of year.	No. of locomotives.
In shops	37.5	137	6	27.3	99	3
In service	62.5	228	10	72.7	266	8
Totals	100.0	365	16	100.0	365	11

TABLE 10—SUMMARY.

	Steam equipment.	Electric equipment.
Passenger service:		
Motor cars	0	14
Passenger locomotives	28	10
Freight locomotives	96	43
Switching locomotives	16	11
Total motor cars	0	14
Total locomotives	140	64

The time in the engine house, where the inspection, cleaning and light repair work is done, will manifestly be much less with electric than with steam locomotives. A steam locomotive receives a thorough inspection after each run, whereas the practice with electric locomotives is to inspect them after they have made a certain mileage, which varies from 1,200 to 2,500 miles, the

former figure being the New York Central standard, while the latter is the practice of the Pennsylvania at New York.

The boiler washing, firebox cleaning and other things required on a steam locomotive, and which consume a large part of the time in the engine house, would not be necessary with electric locomotives and, consequently, the time spent by electric locomotives in or near the engine house would be much less than with steam locomotives. Likewise, electric locomotives would spend less time in the shops than steam locomotives, as there would be no boiler, firebox smoke stack or tender to repair.

As a check on the above figures for number of locomotives required some data will now be given of electrified steam lines in operation. Table 11 below was computed and condensed from data given in a paper by W. J. Wilgus, concerning the electric operation of the N. Y. C. & H. R., and which shows the distribution of steam and electric locomotive time out of the shop.

TABLE 11.

	Hours.		Per cent.	
	Steam locomotives.	Electric locomotives.	Steam locomotives.	Electric locomotives.
Busy	138.00	203.92	20.7	30.3
Waiting	174.10	229.19	26.2	34.2
Total	312.10	433.11	46.9	64.5
Dead	354.90	238.89	53.1	35.5
Grand total	667.00	672.00	100.0	100.0

This data, which is for all classes of locomotives, would indicate that for conditions on the New York Central the steam locomotives were having fireboxes cleaned, boilers washed, light repairs made, and other things which are done in the engine house, a little over half the time out of the shops, while the time spent by the electric locomotives in the engine house being inspected, having light repairs made, etc., was only about one-third of the time out of the shops.

ESTIMATED COST OF ELECTRIFICATION.

The following is an estimate of the money needed to electrify the 467 miles of steam railroad considered:

High tension lines (steel tower), 450 miles		$2,250,000
Trolley and feeder wire:		
3/0 grooved copper trolley, 468 mi. at $650	$304,200	
Steel trolley wire, 156 mi. at $320	49,920	
2/0 feeder wire, 468 mi. at $500	234,000	
		588,120
Overhead construction:		
Bracket arm construction, 420 mi. at $1,650	$693,000	
Span construction, 92 mi. at $2,600	239,200	
Steel bridges, 4 mi.	36,000	
Section breaks	6,600	
Additional for curved track, 100 mi. at $300	30,000	
		1,004,800
Track bonding:		
624 mi. at $450		280,800
Substations:		
14 substations, 56,000 kv-a	$616,000	
3 portable stations, 6,000 kv-a. (complete)	96,000	
		712,000
Rolling stock:		
14 motor cars, $18,000	$252,000	
10 passenger locomotives, $45,000	450,000	
43 freight locomotives, $50,000	2,150,000	
11 switching locomotives, $35,000	385,000	
		3,237,000
Changing block signals and telegraph (468 mi.)		561,600
Engineering and supervision, 5 per cent		431,716
Contingencies, etc., 10 per cent		905,964
Total		$9,972,000
Credit for steam equipment:		
140 locomotives	$2,520,000	
241 coal cars	241,000	
14 passenger cars	112,000	
Give credit for, say, about 70 per cent. of new value.	$2,873,000	2,012,000
Net estimate		$7,960,000

The figures given apply to the intermountain regions of the West. As the actual construction cost was available of a high tension steel tower line parallel to a railroad, the material being distributed by work trains of the railroad, the estimate for this item given should be very close. The trolley line and substation estimates were based upon interurban construction cost of two lines in the west, a liberal allowance being made for the heavier work needed for trunk lines. No item is shown for electric shop machinery as credit for steam locomotive shop machinery will offset this expense.

COMPARATIVE COST OF MAINTENANCE AND OPERATION BY STEAM AND ELECTRIC POWER.

Having determined the amount of traffic of the railroad, and the number of trains necessary to handle the same by steam and electric locomotives, the comparative cost of operation by steam and electric power will now be given.

TABLE 12—MAINTENANCE OF WAY AND STRUCTURES.

	Steam. Per ct.	Electric. Per ct.	Steam.	Electric.
1. Ties	100	92.5	$163,800	$151,515
2. Applying ties	100	92.5	46,800	43,290
3. Rail and other track material	100	85.0	93,600	79,560
4. Applying rail and other track material	100	85.0	32,760	27,846
5. Maintenance and care of track	100	85.0	154,400	131,240
6. Maintenance and care of roadbed	100	100.0	74,880	74,880
7. Signals	100	70.0	23,400	16,380
8. Telegraph	100	120.0	11,700	14,040
9. Engine house and shops	100	50.0	23,400	11,700
10. Fuel and water stations	100	0.0	23,400	000
11. Roadway tools and supplies	100	92.5	23,400	21,645
Totals	...	....	$671,540	$572,096

TABLE 13—MAINTENANCE OF OVERHEAD STRUCTURES AND SUBSTATIONS.

	Steam operation.	Electric operation.
12. *Maintenance of trolley line:*		
Bracket construction, 420 mi., at $100	000	$42,000
Span construction, 92 mi. at $120	000	11,040
Steel bridges, 4 mi. at $60	000	240
13. Maintenance of high tension line, 450 mi. at $50.	000	22,500
14. Maintenance and inspection of substations	000	7,450
15. Track bonding, 624 mi. at $20	000	12,480
Totals	000	$95,710

TABLE 14—DEPRECIATION OF OVERHEAD STRUCTURES AND SUBSTATIONS.

	Steam operation.	Electric operation.
16. *Trolley wire:*		
Copper, $304,200 at 4 per cent	000	$12,168
Steel trolley, $49,920 at 5 per cent	000	2,496
17. Feeder wire, $234,000 at 1 per cent	000	2,340
18. Poles and fixtures, $968,000 at 5 per cent	000	48,400
19. Steel bridges, $36,000 at 3 per cent	000	1,080
20. Track bonding, $281,000 at 4 per cent	000	11,240
21. High tension line, including copper, $2,250,000 at 2 per cent.	000	45,000
22. Substations, $712,000 at 3 per cent	000	21,360
Totals	000	$144,084

TABLE 15—MAINTENANCE OF EQUIPMENT.

	Steam operation.	Electric operation.
23. *Passenger locomotive repairs:*		
Steam, 1,559,828 mi. at 10c	$155,983	
Electric, 1,073,867 mi. at 4½c		$48,324
24. *Freight and switching locomotive repairs:*		
Steam, 2,884,724 mi. at 14c	403,861	
Electric, 1,828,875 mi. at 6c		109,732
25. *Electric motor car repairs:*		
Electric, 971,922 mi. at 3c	000	29,158
26. *Passenger car repairs:*		
Steam, 13,661,220 mi. at 1.2c	163,935	
Electric, 12,735,580 mi. at 1.2c		152,827
27. *Freight car repairs:*		
46,500,000 car mi. at 0.6c	279,000	279,000
28. *Coal cars (company coal):*		
3,850,000 car mi. at 0.6c	23,100	000
Totals	$1,025,879	$619,041

TABLE 16—DEPRECIATION OF EQUIPMENT.

	Steam operation.	Electric operation.
29. Depreciation of locomotives (steam, 3 per cent.) (electric, 2 per cent.)	$75,600	$59,700
30. Depreciation of motor cars, 2 per cent	000	5,040
31. Depreciation passenger cars released, 3 per cent.	3,360	000
32. Depreciation coal cars released, 3 per cent.	7,230	000
Totals	$86,190	$64,740

The steam operating expenses given in Tables 12 to 18 are based upon actual steam railroad operation and the electric operating expenses were computed.

TABLE 17—TRANSPORTATION EXPENSES.

	Steam operation.	Electric operation.
33. *Engine and motormen on switching locomotives:*		
Electric, 70 per cent. of steam	$50,000	$35,000
34. *Engine and motormen on passenger locomotives:*		
Steam, 1,559,828 mi. at 8c	124,786	
Electric, 1,073,867 mi. at 8c		85,909
35. *Engine and motormen on freight and work locomotives:*		
Steam, 2,262,250 mi. at 11c	248,848	
Electric, 1,329.764 mi. at 11c		146,275

	Steam operation.	Electric operation.
36. *Engine and motormen on helper locomotives:*		
Steam, 225,475 mi. at 12c	27,056	
Electric, 76,241 mi. at 12c		9,149
37. *Car motormen:*		
462,820 mi. at 2c.	000	9,256
38. *Conductors and brakemen in switching service*	90,000	90,000
39. *Passenger locomotive train crews:*		
Steam, 1,485,550 mi. at 6.8c	101,017	
Electric, 1,022,730 mi. at 6.8c		69,546
40. *Motor car trainmen:*		
462,820 mi. at 4c	000	18,513
41. *Freight and work train crews:*		
Steam, 2,262,250 train mi. at 13c	294,093	
Electric, 1,328,764 train mi. at 13c		172,739
42. *Fuel:*		
400,000 tons at $2.25	900,000	000
43. *Purchase of power:*		
90,000,000 kw-hr, at 0.75c	000	675,000
44. *Water*	$2,000	000
45. *Lubricants*	14,000	6,000
46. *Other locomotive supplies*	23,000	16,100
47. *Enginehouse expenses, locomotives:*		
Steam, 40,000 locomotives at $2.50	100,000	
Electric, 14,000 locomotives at 80c		11,200
48. *Enginehouse expense, motor cars:*		
3,000 motor cars at 50c	000	1,500
49. *Signal operation*	40,000	35,000
Totals	$2,064,800	$1,381,187

Table 18—Summary—Operating Expenses.

	Steam operation.	Electric operation.
A. Maintenance of way and structures	$671,540	$572,096
B. Maintenance of overhead structures and substations	000	95,710
C. Depreciation of overhead structures and substations	000	144,084
D. Maintenance of equipment	1,025,879	619,041
E. Depreciation of equipment	86,190	64,740
F. Transportation expense	2,064,800	1,381,187
G. Taxes		31,551
Totals	$3,848,409	$2,908,409

Steam operation expenses	$3,848,409
Electric operation expenses	2,908,409
Annual saving effected by substitution of electric power	$940,000

The published figures of the N. Y. C. & H. R. show that the steam locomotives cost $1,842 for repair during 335 days, while the electric locomotives cost $704 during 350 days, for the same service. The electric locomotive repair cost on the N. Y. C. & H. R. is thus only 36.5 per cent. of the steam locomotive repair costs.

The figures published by Mr. Gibbs of the Pennsylvania give the electric locomotive repair cost as 5.91 cents per locomotive mile, the New Jersey division steam locomotive repair cost as 8.83 cents per locomotive mile, and the average of steam locomotives for all divisions of the Pennsylvania as 11.9 cents per locomotive mile. The electric locomotive repair expense is thus only 67 per cent. of the steam expense on the New Jersey division and only 50 per cent. of the steam repair expense on all divisions. The annual mileage of the electric locomotives was 26,000, 28 per cent. of which was switching. The heavy grades on the electrified section of the Pennsylvania of course make the repair cost of electric locomotives considerably higher than if they were operated over a section with the grades as low as the average of the whole road, and consequently the relative cost of steam and electric locomotive repairs will be even less than shown. The electric locomotives of the P. R. R. are also much more powerful than the steam locomotives.

All things considered, it is probable that the electric locomotive repair cost will be even lower than 45 per cent. of the steam locomotive repair cost, which was estimated above for the road considered and used in making the comparative estimate of steam and electric operating expenses. For the road considered, the repair expense for steam passenger locomotives was taken at 10 cents per locomotive mile, and steam freight, helper and switching locomotives 14 cents per locomotive mile, which figures were based on the present locomotive repair costs on a western railroad where similar conditions exist. The electric locomotive repair expense will thus be 4.5 cents per locomotive mile for passenger locomotives and 6 cents per locomotive mile for freight service.

An electric locomotive will have a longer life than a steam locomotive, and thus the rate of depreciation will be less. The statement below shows the depreciation percentages used in the above tables. The steam locomotive figures were obtained from the auditing department of a western line. The electric figures were estimated, and although the modern electric locomotive has been in use only half the time allowed below for its life, I think past experience justifies the expectation of life allowed.

	Steam locomotive. Per cent.	Electric locomotive. Per cent.
First cost of locomotive	100	100
Salvage value when worn out	20	30
Total cost	80	70
Estimated life	26⅔ yr.	35 yr.
Annual depreciation	3%	2%

The wages of the motormen on the electric locomotives were assumed to be the same as those of the enginemen on the steam locomotive, but the motormen on the electric motor cars were taken as equal to about what would be paid for trolley car service. Although no fireman is needed on electric locomotives, two men were assumed necessary for all electric road and helper locomotives; but on switching locomotives, which have a conductor, and sometimes two or three switchmen, only a motorman was allowed. When two electric locomotives are used on a helper district to assist the road locomotive, only one crew was allowed, as the electric helper locomotives, being equipped with multiple-unit control, can be operated by one crew.

All coal used on a steam locomotive is not utilized in hauling trains, but a good deal is wasted by radiation while the locomotive is standing on sidings, imperfect combustion in the firebox, starting fire, etc., and the loss of energy is very much greater than would be the case in a steam electric plant generating power for electric operation of a railroad. The figures published by W. S. Murray in the March, 1908, Proceedings of the American Institute of Electrical Engineers, indicate that it requires about double the coal for operation of the steam locomotives of the N. Y. N. H. & H. that it does to generate power in a steam electric power plant for operation of its electric locomotives in the same service.

The quantity of electric power needed was computed from the grades, train weights, speed and other necessary data, the average power for a train of two motor cars and trailer, making stops every six or eight miles, being taken at 40 watt hours per ton mile, the passenger locomotive trains being allowed 31 watt hours per ton mile. The freight trains were allowed 25 watt hours per ton mile and the switching locomotives 45 watt hours per ton mile. As stated above, the power is to be purchased and delivered into the railroad's high tension transmission line at terminal No. 3. The rate to be paid for electric power in any locality depends upon the local conditions, the load factor, etc.

In many sections of the West, the development of numerous extremely low construction cost hydroelectric plants has made it possible to obtain power to some points at considerably lower cost than 0.75 cents per kw-hr., which was used in the above estimate. For instance, the Great Falls Power Company has made a rate of 0.536 cents per kw-hr. to the Chicago, Milwaukee & Puget Sound, and agrees to construct some of the high tension lines.

It is estimated that it only costs one-third as much to handle an electric locomotive through the engine house as it takes to handle a steam locomotive. At $2.50 per locomotive for steam operation would mean about 80 cents per locomotive for electric operation. The New York Central figures published by Mr. Willgus gives $3.37 per day for steam locomotives and 55 cents for electric locomotives, or the electric cost of engine house expenses only 16.3 per cent. of the steam.

RETURN ON INVESTMENT.

The estimated cost of the electrification of the 467-mile railroad considered above was $7,960,000. The return on this investment on account of the saving in operating expense was estimated at about $940,000 per year. The interest earned on the money used for the electrification of this road would thus be 11.8 per cent. If it is necessary to borrow the money for this purpose, and if it can be obtained at 5 per cent. interest, there would remain a profit to the railroad of 6.8 per cent. of the net cost of electrification.

Maintenance of Way Section.

THE statistics of the Interstate Commerce Commission for the year ending June 30, 1912, show that 565 track and bridge men were killed and 645 injured by being struck by trains, in addition to 95 who were killed and 1,115 who were injured in other accidents. The number of track and bridge men employed for one killed was 579, and for one injured, 21.7. This record is emphasized by an accident on one of the eastern roads recently, where in a gang of foreigners recently arrived, ten were killed and a number injured by being run down by a passenger train, while running away from a blast and dodging another train. These figures show the necessity for placing special emphasis on the instruction of foremen regarding their responsibility in protecting their men from accidents. By far the larger proportion of accidents is avoidable if proper care be exercised. And the need for this care has risen greatly within the past few years owing to the largely increased number of foreigners employed in this department. The matter referred to is one that cannot be left solely to the foremen, but should be constantly brought to their attention by the higher officers.

THE extent to which the application of heavier rail and more ballast will actually reduce the cost of maintenance of branch lines with only a moderate traffic is often overestimated. The results secured are quite different from those on main lines carrying a heavy traffic, where heavy construction is essential, if maintenance charges are to be kept from becoming excessive. Very frequently in requesting an appropriation for the improvement of a branch line the local officers will make the statement that the cost of maintenance will be materially reduced. An actual comparison of the expenditures before and after improvement of the track will generally fail to show any marked reduction. Undoubtedly, less work is required to maintain a branch line track with 85 lb. rail and good ballast, than, for instance, one with 65 lb. rail with little or no ballast, but the difference usually is not sufficient to justify taking a man off a section. Rather, the result is that a better track is maintained for the same expenditure, and the track forces are given opportunity to keep up fences, buildings and other work which may have been neglected previously. Another important result not always considered is in the increased facility with which the trains are enabled to get over the road or in the increased tonnage which they are enabled to haul in the same time. While individually slight, many irregularities in line and service, as well as in greater elasticity and increased wave motion with light track construction, are cumulative in effect. Thus, rather than a decreased cost of maintenance, the result usually secured is a better track for the same money, and a better train movement or loading.

THE defects in the railway scale and weighing conditions have been brought out prominently in the recent hearing before the Interstate Commerce Commission, and a number of conditions not entirely creditable to the railways have been exposed. As a result, this subject has been given more attention by the railways themselves than ever before, and a large number of new scales has been installed, while many others will be in the near future. For this reason the action of the American Railway Association in adopting the specifications published in another column as good scale practice is timely and valuable. Up to this time there has been almost no authentic information available regarding the design of scales, and the railway official studying the question has been severely handicapped. Scales have been generally purchased upon the ratings and designs of the manufacturers, and there has been no opportunity to compare one design with another on any equitable basis, or to ascertain if any individual design met the actual service requirements. This situation has resulted from conditions for which the railways and manufacturers are jointly responsible. Because of the inability to intelligently compare different designs of scales they have been purchased very largely upon the basis of first cost. As a result, in an effort to reduce the cost of manufacture the weight of the various parts has been reduced to a minimum and the scale rating has come to mean very little. This cheapening of the design by some manufacturers has forced others to do likewise if they were to secure any business. With a general specification which the railways can use when installing new scales, and in accordance with which all the manufacturers can design on an equal basis, the present situation should be materially improved.

THE layout of a ballast pit or quarry has an important influence on its economic operation; and it is usually difficult to correct errors in the original plans after the pit has once been operated. As the cost of the ballast on board cars forms a large part of its total cost in track, the effect of this cost on maintenance expenditures is substantial. For these reasons the description of the El Paso & South Western quarry at Tecolote, N. Mex., and the figures of the cost of operation, published in this issue, are valuable. Very often ballast is purchased from outside parties on the assumption that the road cannot prepare it as cheaply as it can buy it. This may be true when washed gravel is used, and when the profits are largely secured from the by-products of sand and roofing gravel. It may also be true when, under favorable local conditions, stone is used. There are, however, many places where a road can afford to build its own quarry to good advantage. It is interesting to note that following a visit to this Tecolote quarry by representatives of another western road, the latter has authorized the installation of a crushing plant of its own and, incidentally, has brought down the contract price of its crushed stone several cents at other points. In view of the large quantities of ballast of various kinds required on the average large system a comprehensive study of the best materials to use on various lines should prove advantageous. This study should include the demands of the traffic, standards of maintenance, the kinds of material available, the sources of supply, etc. One road is now seriously considering the assignment of one man to devote his entire time to studies of this nature and to supervise the preparing and distribution of ballast at the various pits and quarries on the system.

IN common with other branches of railway service, maintenance work very generally suffers from a lack of sufficient supervision. This results largely from two causes. In the first place, the average supervisor is given charge of more forces than he can intelligently handle. Again, many men place too much dependence on correspondence and inspections made from the rear end of trains accompanied by the promiscuous use of "butterflies," and spend too little time with the various gangs on the work. While the first condition is beyond the control of the supervisor, he is responsible for the latter condition which is largely one of method. At this season of the year when repair work of all kinds is at its height, it is important that he spend as much time as possible with his gangs. As the money is actually being spent in the field it is more important that the supervisor be on the ground directing its economical expenditure than in the office explaining how it is being spent. Probably the most promising field of study for him is that of devising means of eliminating lost time. The amount of time actually wasted by the average gang is a surprisingly large percentage of the total. Although this has come to be commonly regarded as a necessary evil, it can in many cases be remedied

to a large degree. By studying the proper distribution of men in each gang, the proper size of gangs, the ability of the different foremen to direct men, and more particularly, by training the foremen themselves to study and correct these leaks, surprising results can be gained. Without such encouragement by his superior officers the average foreman will pay little attention to this matter. Again, by maintaining thorough familiarity with conditions, a supervisor can keep his foremen keyed up where they will make their best efforts. When they learn that he can detect at once when they have made a creditable showing or have failed to do so, they are more likely to do their best. Likewise, with such supervision, inefficient or incorrect methods can be detected and corrected so that they will be avoided in the future. In these ways the efficiency of the forces can be increased and the foremen themselves strengthened. These advantages are not fancied, but are being realized by numerous men today. One officer in charge of a portion of a main trunk line recently made a study of his expenditures for the past year as compared with five years ago, and found that although the amount of work actually done has steadily increased, he has made a saving of over $100,000 yearly in actual expenditures. He attributed this to the fact that he has aimed to spend nearly all his time with the foremen in the field assisting them to close leaks here and there. Similar results are possible on many other lines where the officer, perhaps unconsciously, has allowed himself to be tied down too closely to his desk to the detriment of the work on the line.

BOARDING CAMPS AND THE LABOR SHORTAGE.

NOT many years ago any railway man who ventured to suggest that common laborers employed on construction and maintenance work be provided with anything beyond the actual necessities, exposed himself to ridicule. This condition has changed. Many contractors have been quick to see the direct advantages of providing good quarters for their men and taking an interest in their welfare, even to the extent of providing recreation after working hours; and some railways are following their lead. The old idea still prevalent on many roads that any car not fit for anything else can be used for a bunk car, and that the boarding privilege should be let to the contractor making the company the largest percentage, is fast losing ground. Changing public sentiment, combined with the distinct labor shortage of the past few years, is prompting the giving of greater attention to these details.

The problem of sanitation is a serious one about any camp, for if it is unhealthy, the efficiency of the men will be affected. The average railway laborers' bunk car has been conspicuous for years for its lack of attention. Greater care exercised in the fitting up of these cars and in their maintenance and fumigation will eliminate much of the present complaint. Better cars are now being used on many roads, the wooden bunks are being replaced with metal and help is employed by the camp to keep the cars in proper condition.

In adopting precautionary measures against disease, contractors have again led the railways. Many contractors have had doctors, at least in their larger camps, for years, who supervise the condition of the men and camps and give aid to the sick and injured. While the average railway camp would undoubtedly not justify such an expenditure, it should be possible for one doctor to supervise a number of camps located on the same or adjoining divisions. Such precautions are especially advisable in handling contagious diseases. The prompt discovery and isolation of any laborer so afflicted will, in most cases, prevent the disease from spreading through the entire camp and eventually shutting down work entirely.

Public opinion is strongly against allowing camps where large numbers of men are herded together in unsanitary quarters to be maintained in the vicinity of towns or cities, and complaints frequently arise from this source. A number of investigations and reports on this subject have been made, particularly in eastern states, and the fact that the subject is still a live one is shown by a recent report of the Bureau of Industries and Immigration of the State of New York, in which it is stated that there are at present 2,000 unsanitary camps in that state housing 50,000 employees. If publicity continues to be given to such reports some states will soon give their boards of health authority to control conditions in construction camps. The best way the roads can control the imposition of stringent requirements by such boards is for the roads voluntarily to remedy the conditions.

Appearing even more radical than the precautions taken to safeguard health in the camps are the measures provided in some cases for recreation for the men outside of working hours. This class of welfare work has been done in other industries for several years, evidently with good results. Contractors engaged in railway and other heavy construction in remote parts of the country have also found that Y. M. C. A. branches or recreation rooms have been a valuable means of holding labor. As an instance one large contractor employing large numbers of negroes early this spring provided an electric piano and a dance floor in his camp. Upon discontinuing this a few weeks ago he noticed at once such an increased difficulty in securing labor that he has put the piano and dance floor in service again. The installation of shower baths in the recently constructed timber treating plants has proved a valuable adjunct in holding labor at these places, and at least one railroad is now considering the installation of shower baths in a construction camp. This same road is also planning to put up a recreation building at this camp where the men can read or talk outside of the cars in which they sleep, believing that the small amount of money spent for improving the condition of their living quarters and providing amusement for them while not at work will be money well spent.

While these measures undoubtedly appear unwarranted to the average men familiar with conditions of a decade or more ago, they are nevertheless attracting the serious consideration of those railway men who are beginning to feel a greater responsibility for the welfare of their laborers and who also feel that as a business proposition, money spent in providing more attractive quarters will repay a good interest on the investment as a means for holding laborers.

NEW BOOKS.

Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association. Published by the association. F. J. Angier, secretary and treasurer, Baltimore, Md. Size 6 in. x 9 in., 481 pages. Price, cloth, $3.50; paper, $2.50.

The standing which the American Wood Preservers' Association has attained by the earnest work of its officers and members in the past few years is reflected by the character of the annual proceedings which have just been issued. This book is the largest ever published by the association and in many respects is the most valuable.

It contains a full report of the convention held in Chicago, January 21-23, 1913, at which more papers were presented than at any preceding meeting and the discussions were fully up to the standard set in recent years. In addition to the report of the meeting, the list of members and the constitution and by-laws of the association, the book contains considerable statistical information of interest to railway men in general. A number of maps and tables presented show the production of lumber in the United States, the number of crossties and poles purchased, the location of treating plants in reference to the timber bearing regions and a complete list of timber treating plants in the United States, Canada and Mexico. There is also a brief resume of Forest Service investigations including brief abstracts of the most important bulletins that have been published from time to time.

TUNNEL LINING ON THE VIRGINIAN RAILWAY.

Details of the Methods Used in Placing Concrete Linings in Eighteen Main-Line Tunnels without Interruption to Traffic.

The Virginian Railway let a contract about two years ago for the lining of 18 tunnels on the upper portion of the road. Three are now completed, work is under way on two more and the others will be undertaken at a rate which it is expected will finish this contract in about three years more. Most of these tunnels were timber lined when they were built, but some, which are located in hard material, were left unlined. A rather serious cave-in of one of these tunnels showed that the unlined ones are not as safe as could be desired, and it was therefore decided to undertake the lining of all tunnels about the safety of which there was any question. The concrete linings which are being placed are built to four standard plans, for large and small sections, and with and without reinforcement, as shown in the accompanying cross sections. Work is being done without interruption to traffic, and on account of the size of the contract the contractor and the company's engineers have together developed a system for handling the work which is proving very efficient.

Concrete Car with Two High Levels for Shoveling into Upper Portion of Forms.

Placing Concrete in Parapet Wall at Portal by Shoveling Twice.

The details of the work at the tunnel about two miles east of Princeton, W. Va., will serve to illustrate the methods used on all of these jobs. This tunnel is 1,700 ft. long, the material being comparatively soft stone, which is loose in many places and is rather wet. On account of the character of the material the reinforced concrete lining is being used, and on account of the size of the bore the large section is required. This section is 23 ft. 6 in. high from sub-grade to invert and 18 ft. 4 in. wide, the walls being vertical from the springing line down to a line 5 ft. 7 in. above sub-grade. From that line down they are battered to give a footing 3 ft. 6 in. wide for the support of the wall. The minimum thickness of the lining inside the old timber rings is 15 in., the walls being 2 ft. 3 in. thick from the face of the old lagging. An 18 in. gutter is provided inside the footing. The reinforcement in the footing consists of three ¾-in. rods laid longitudinally, which are used only in yielding material. The reinforcement in the side wall consists of vertical ¾-in. rods spaced from 2 to 3 ft. apart, as required by the character of the material. These rods are long enough to extend about 4 ft. above the springing line and are bent to form a bond with rods in the arch ring. The ring reinforcement also consists of ¾-in. rods placed in three pieces; the lower pieces coming down to the springing line overlapping the wall rods by 4 ft. and the middle rods, or key reinforcement, overlapping the upper ends of the other rods 3 ft. In addition to this reinforcement there are 19 ¾-in. rods placed horizontally, as shown in the accompanying cross section.

The concrete mixture is 1:3:6. The section used in this tunnel required 5 cu. yds. of concrete and 100 lbs. of reinforcing rods per lineal foot of tunnel. The small section unreinforced requires 4.7 cu. yds. of concrete per lineal foot, the small section reinforced, 4.4 cu. yds of concrete and 100 lbs. of steel, and the large section without reinforcement, 6.4 cu. yds. of concrete. Refuge niches 3 ft. wide are provided at intervals of 200 ft. on each side, staggered. Weep holes in the side walls just above the gutters are spaced a maximum of 50 ft. center to center, 3 in. galvanized iron pipe being used for this purpose. In particularly wet places, holes were bored through the old lagging and 4 in. drain tiles were placed over these holes to carry the water to the weep holes. Where necessary, these drains are provided at intervals as close as 10 ft. In some cases wooden boxes were substituted for the drain tiles, these boxes being 3 in. square inside and framed of 1 in. material, unfinished. The back of the portal is sloped to drain all surface water to a concrete basin built into the back of the portal wall at one extreme end, from which the water is carried through a hole in the parapet wall and down a concrete drain to the roadway ditch. The construction of this drain is clearly shown in one of the accompanying photographs.

The concrete plant for handling this work is located at the

end of the east approach cut, about 300 yds. from the portal. The sand and stone for concrete are brought in in coal cars, the stone being secured from the Sinking Creek quarry about 35 miles away, and the sand from Norfolk, Va. This material is unloaded by a 65 ft. derrick and one yard clam-shell bucket into storage piles having a capacity of 250 yds. of sand and 350 yds. of stone. The cement house holds 2,000 bbls. A water tank with a capacity of 3,000 gal. supplies water by gravity to the mixer and the dinky engine which operates the concrete car in the tunnel. In order to carry on the work in cold weather, a small vertical boiler near the mixer is used to heat the mixing water and steam pipes are laid in the sand and stone storage piles to heat these materials. The water is heated whenever the temperature falls as low as 32 deg. and the sand and stone when the temperature reaches 28.

The unloading derrick which takes the material from cars is

Concrete Drain for Carrying Water from Back of Parapet Wall Down to Roadway Ditch.

used to place the sand and stone from the storage piles into hoppers over the mixture plant. These hoppers have a capacity of 25 yds. of stone and 20 yds. of sand. From these bins the material is dropped into a steel proportioning hopper directly over the mixer. Two men are stationed on the platform above the mixer to proportion the materials, being guided by lines ruled on the inside of the steel hopper so placed as to give the exact quantities of the aggregate needed to secure a 1:3:6 mixture. Each mix is proportioned on the basis of two sacks of cement. The cement is trucked out from the storage house and loaded on a steel skip which is set up on the platform in front of the mixing hopper by a second derrick which is used to handle the concrete buckets. From this skip the men in charge of the proportioning of the material take their bags of cement. The half yard Smith mixer dumps into 1 yd. buckets, two batches being dumped into each bucket and two buckets being filled during the interval that is required for the train to run into the tunnel and place the concrete. When the train returns to the mixing plant the derrick swings these two buckets of concrete that have been loaded over the cars and they are dumped on the shoveling platforms.

To provide electric power for lights in the tunnel and in the

Concrete Mixing Plant, Material Hoppers at Top, Proportioning Platform Below, Mixer at Bottom.

camp, a generating plant is installed which has a 14 k. w. generator furnishing 112 volt d. c. current. The generator is driven by a 20 h. p. engine, belt connected, which receives steam from the 40 h. p. boiler that serves both the light plant and the pumping plant.

The forms are built of long leaf pine dressed on all four sides. By careful handling this form lumber is used four or five times. All forms are framed in place, the posts being set up and lined after which the lagging is put in as required. The waling strips at the top of the battered section of the side wall and the wall

Portal of the Tunnel Near Princeton, W. Va.

plates at the springing line are bolted back to the old timber lining, the waling strip at the top of the footing being wired. The concrete is placed in sections 48 ft. long. The footings are first laid, then the side walls are put in up to the springing line in a single operation. During the placing of these side walls the vertical reinforcing rods are held in place by nailing 2 in. by 4

in. scantlings longitudinally along the old timber rings a little above the springing line to which the tops of the rods can be wired. The longitudinal rods in the side wall are placed as the concrete is carried up. With the exception of the key, the arch ring is also placed in sections 48 ft. long by placing three or four boards and filling over these and then placing more until the entire ring is turned with the exception of the 3 ft. key section at the top. This key section is placed in 4 ft. lengths by

Building the Portal.

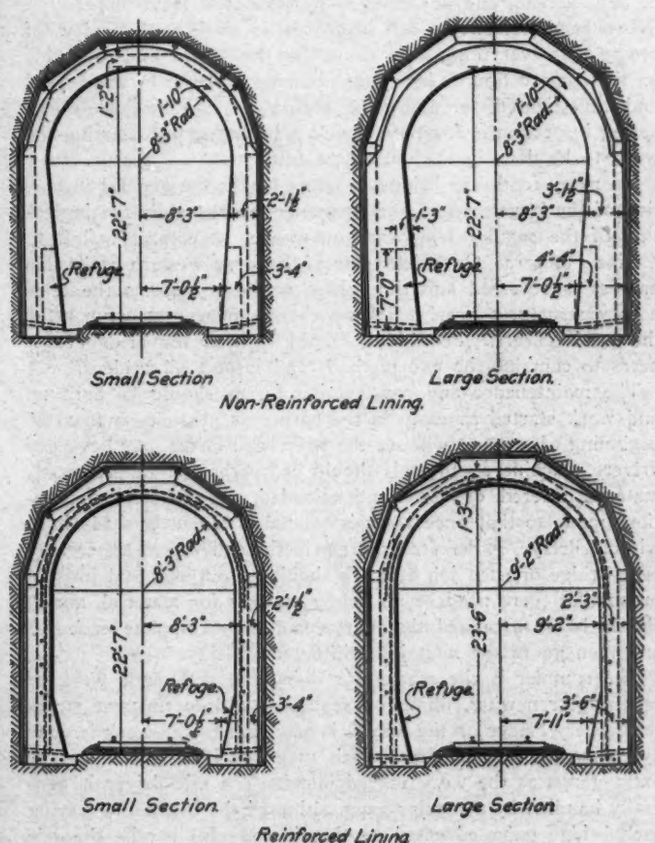
shoveling back after the closing forms have been placed. About 2 in. of mortar is placed over the forms in the key section before the concrete is put in order to insure a neat cement finish. Expansion joints are provided at the end of each 48 ft. section and adjacent sections are firmly keyed together. Forms are never removed within 72 hours after placing the concrete. The use of corrugated tin for protecting the concrete from moisture is being tried in this tunnel. This tin is placed in sheets behind the side walls and above the arch ring before any concrete is placed and before the forms are completed. The sheets are bent around the old timber posts and arch rings so as to fit the old

Train Used for Carrying Concrete from Mixing Plant to Tunnel.

timber lining closely and allow the concrete to fill the entire space. Where necessary, holes are cut through the old timber lining in order to allow the water collecting above to flow down behind these tin sheets to reach the weep holes at the bottom of the wall.

The concrete is brought into the tunnel in 2 yd. batches on a train consisting of a dinky locomotive and two cars. One of these cars is an ordinary flat car from which the concrete in the footings and lower section can be placed, and the other is a flat car on which staging has been built to provide two higher floor levels from which the concrete can be shoveled into the upper portion of the side walls and the arch ring. The shoveling platforms are covered with sheet iron. Eight laborers are used on this car to shovel concrete into the forms and four men are kept in the tunnel to spade back the concrete from the face of the forms. The sequence of operations has been very carefully worked out so that no time is lost in the operation of this train. When the lower portion of the side wall is being placed it is possible to handle 125 yds. of concrete in a ten hour shift, although the delay occasioned by the difficulty in placing the upper portions of the arch ring, and particularly the key section, cut down the general average to 50 or 60 yds. per shift. In order to eliminate delay caused by the building of forms, concreting is carried on at two points in the tunnel alternately.

As it is necessary to operate the concrete train over the main line, it is necessary to protect regular train movements very



Cross Section of Completed Tunnel Linings.

carefully. A man is placed at each end of the tunnel with telephone equipment connected to the despatching circuit, who warns the dinky of an approaching train and who gives clearance cards to all main line trains. No train is allowed to enter the tunnel without first stopping for this clearance. There are two regular passenger train movements a day, and from 5 to 12 freights. On account of the length of these freights and the slow speed at which they move and the occasional delay due to breakdowns in the tunnel, the total amount of delay from trains is a very considerable item.

This work is being handled under the supervision of H. Fernstrom, chief engineer, B. T. Elmore being division engineer in direct charge of the work in the field. The contract is being executed by W. W. Boxley & Co., Roanoke, Va.

RUSSIA'S PURCHASE OF RAILWAYS.—The Budget Committee of the Duma has agreed to the early purchase of the Moscow-Kasan Railway, and has expressed a wish that a bill for the purchase of the Lodz-Raisan-Ural Railway be drafted.

BRIDGE MAINTENANCE.*

By Engineer.

Bridge work is a perpetual and continuous job like track and all other classes of railroad work, but the kind and amount of the different varieties of the work changes with the seasons. In the winter surveys should be completed and plans made for future work, and maintenance should be kept up at the least possible expense. Light construction work should be dropped while heavy construction work on abutments, piers, and mass concrete can be pushed to advantage, especially in localities where the ice is strong enough to be of assistance in handling the work, and also where low water is necessary.

In the spring all bridges should be closely inspected and the necessary repairs ordered. Various methods for making inspections are in vogue. The general inspection may be annual or semi-annual, and be added to by periodical local inspections. When semi-annual, the fall inspection is made with a view of seeing that everything is in shape for the winter and to decide on the construction or heavy maintenance work to be considered and investigated for the next season's operations, while the spring inspection is for the purpose of planning and starting the work to be done in the immediate future.

On many roads the bridge engineer makes the general inspection of the large bridges and permanent work, while the inspection of the smaller temporary or wooden structures is left to the local officers. On at least one of the large western roads this process is reversed and the bridge engineer inspects the temporary structures yearly, leaving the permanent structures for the local officers. Possibly it would be well for bridge engineers to combine the two methods and inspect all bridges.

The maintenance and construction forces should be built up and work started as early in the spring as possible so that the beginning of summer will see the work well under way. All pile drivers, machinery and tools should be overhauled and repaired; material ordered, delivered and unloaded, and complete preparations made so that once work is started it can be pushed ahead without delay. A definite program in the delivery of material to each bridge or each job of work should be outlined and insisted on so that there need be no delays waiting for material, and it should be so arranged that gangs can fully complete each job and then go to the next job without any delay.

The summer is the season for doing the systematic work of repairing, renewing, filling or replacing with permanent structures every bridge on the line as it may need. The work is done by gangs of various sizes which may be either permanent or extra gangs as the work may demand. The pile driver is generally handled by a regular gang, although the method of having each bridge gang educated so that it can also handle the pile driver is sometimes advocated. However, as each road tries to get along with a minimum number of pile drivers so that it is desirable to keep them working at their maximum efficiency at all times, this latter method is of doubtful economy.

On account of the scarcity of foremen and of labor and the advantage of getting work done immediately with as little traveling as possible the combining of the bridge work with section work, signal work and other maintenance work is beginning to be advocated. There are many strong arguments in favor of this and should it be found successful it is likely to re-organize our entire maintenance system and methods. The past 15 years have witnessed very radical changes in the construction of permanent waterway openings due to the use of concrete and steel, and the future will be likely to add to these and thereby also change our methods of maintenance.

As temporary bridge structures are replaced by steel and concrete the amount of maintenance work is very materially decreased. Bridge gangs are replaced with carpenter gangs, painters' gangs, plumbing gangs, etc., as development of the country necessitates. The building up of towns and cities makes it necessary to do much more work around the station grounds than formerly, and the quality and kind of work varies with the nature of the public improvements. Sewers, pavements, permanent platforms, water supplies, plumbing, electric lighting, electric power and other features of latter day progress make it necessary for the railroads to employ specialists who can best handle the necessary work.

Small jobs of construction work and indeed all construction work that it is possible for them to handle should be done by the regular maintenance organization, but large construction jobs require a separate organization which should be flexible as to size and which can be moved from place to place as exigency requires.

Permanent structures in the past have been largely put in by contractors, mainly for the reason that the railroads have not had the necessary equipment for handling the work. However as they have become larger and permanent work has become more general, it is now becoming customary for the railroads to do their own masonry and steel erection work. Whether they save money in all cases by doing this is questionable, when the cost of the equipment with interest and depreciation is taken into consideration. Undoubtedly where construction work is continued from year to year requiring permanent forces, outfits and machinery, they save the contractor's profit, but in many cases the amount of work and the inexperience of the men makes the cost more to the railroad company, although this fact may not be evident on the surface of their accounts.

During the summer months all the bridge work should be pushed to completion as rapidly as possible, so that in the fall all that remains to do will be to get every bridge and opening in shape for the winter. This not only means that its strength and condition should be cared for, but that the waterways themselves, including the channels and ditches, should be clean and free from obstructions, so that there will be a free flow of water to and from the openings, that the openings may fulfill the purpose for which they were constructed.

As most of the railroads in this country were constructed in a time when timber was cheap, many pile and trestle bridges and timber culverts were built which are being replaced more or less rapidly with permanent structures. This has been accelerated of late years by the use of concrete and the consequent cheapening of the permanent openings. The life of the timber bridges has also been lengthened in many cases by the use of creosoted timber. This material is especially applicable in cases where the bridge decks have to be replaced oftener than the piles, and many years are often added to the life of the bridge by the use of a creosoted deck which may be filled in and ballasted.

When the original timber bridges were built, but little attention was paid to the size of opening required to properly carry the water, so long as it was large enough.

With permanent structures this is not a sufficient rule on account of the greater cost, and the size of openings should be proportioned to the use required of them. This makes necessary complete surveys and investigations of the bridge, its drainage area and outlet. These surveys should be made or started as early in the fall as possible, so that time may be had for considering each bridge and designing the necessary structure, culvert or pipe for the opening in order that the material may be ordered and delivered in time for the next summer's building.

In considering the amount which can profitably be spent for replacing temporary with permanent structures, the first cost of the temporary bridge should be taken together with such an amount as will, when put at interest at current rates, provide for its maintenance and periodical replacement at such times as it may wear out. A common wooden pile bridge can be replaced by a permanent reinforced concrete pile bridge on a ratio at present-day prices of about 3 to 1, while there are many cases of bridges or trestles which can be replaced by reinforced concrete culverts, boxes or pipes for even less than the cost of a

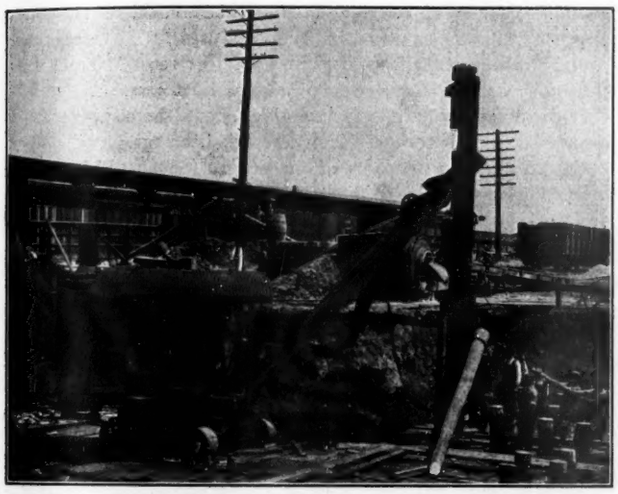
*The fifth of a series of articles on timely maintenance topics. The first appeared on page 351 of the issue of February 21, the second on page 498 of the issue of March 14, the third on page 905 of the issue of April 18, and the fourth on page 1091 of the issue of May 16.

wooden structure. The use of reinforced concrete for many railroad structures is growing rapidly and merits the full investigation of every railroad engineer. Pipes, culverts, boxes, highway bridges, subways and over-crossings, arches, trestles, bridges and retaining walls are now being permanently and cheaply constructed of this material, to say nothing of buildings, tanks, coal chutes and other uses for which it is being rapidly adopted.

THEW STEAM SHOVEL USED AS A PILE DRIVER.

A No. 0 Thew steam shovel was recently used in a novel manner in constructing the foundation for a passenger subway for the New York Central station at Utica, N. Y. The shovel was originally used to make an excavation about 165 ft. long, 40 ft. wide and 10 ft. deep, with three bays on each side each about 20 ft. square. After the excavation was completed it was necessary to drive piles under the sidewalks, center piers and stair piers in these bays. In all about 250 spruce piles 13 to 16 ft. long were used.

Owing to the limited working space and the difficulty of moving an ordinary pile driver into these bays it was decided to convert this small steam shovel into a pile driver, to obtain the advantage of its self propulsion and the full circle swing of the boom. The bucket was removed from the shovel and a pair of 26 ft. leads were attached by means of 3-in. x 10-in. plank bolted to the boom as shown in the accompanying photograph. The thrusting arm was bolted to the leads so that when it was fully extended they were in a vertical position. A No. 3 McCoy "Monarch" steam hammer weighing 2,800 lbs. was mounted in the leads.



Thew Steam Shovel Used as a Pile Driver.

When moving this driver the hammer was staged just above the foot of the leads. When over the location of a pile the hammer was lowered to the ground, permitting the leads to rise slightly as the load was removed. The foot of the leads was then supported roughly on blocking, a rope was passed through the bale of the hammer and it was hoisted, carrying the pile with it, as there was no way to attach a separate pile fall. After driving a pile the foot of the leads was pulled in toward the shovel by the thrusting arm until it cleared the pile, permitting the shovel to move or revolve in the usual manner.

Although considerable trouble was experienced with soft bottom, requiring the shovel to be carried on plank throughout the work, an average of 19 to 20 piles were driven in a ten-hour day, the smallest number being 15 and the highest 27. The actual time of driving averaged from 10 to 14 min. While a heavy hammer would have been desirable for faster driving, it could not have been placed on this shovel. As it was, it was necessary to weigh down the back of the shovel by suspending about 400 lbs. of iron from the I beams beneath the boiler. When the driving was completed the leads were removed and the bucket replaced in less than three hours.

The performance of so small a steam hammer on piles of 11 and 12 in. butts is interesting. The piles were driven until a penetration of about one-half in. was secured under 40 blows. A drop hammer weighing 1,860 lbs. was used on an adjoining contract which touched the subway at one point. Hardwood piles of the same size were used here and were driven to a penetration of one-half in. under a 30 ft. fall. As the steam hammer had driven its piles from three to four ft. lower than the drop hammer it was thought desirable to try it on the piles which the drop hammer had been unable to put down deep enough. The steam hammer was therefore substituted for the drop hammer and although the piles had been driven several days before the small steam hammer was not only able to start them but secured a penetration of three ft. additional.

The alteration of this Thew shovel was devised by A. A. Parker, of Waterford, N. Y., associated with H. R. Beebe, Utica, N. Y., the contractor on the subway.

ABSTRACT OF ENGINEERING ARTICLES SINCE MAY 16, 1913.

The following articles of special interest to engineers and maintenance of way men and to which readers of this section may wish to refer, have appeared in the regular weekly issues of the *Railway Age Gazette* since May 16, 1913:

Some Disputed Points in Railway Valuation.—A series of editorials discussing variations in the methods adopted in the different valuations made up to this time, including investment from earnings, depreciation and intangible values, appeared in the issues of May 23, page 1018; May 30, page 1164, and June 6, page 1208, respectively.

New Kansas City, Mo., Passenger Terminal.—The next to the largest terminal development now under way in this country is that at Kansas City, Mo., where a new $5,000,000 station, a belt line around the city and freight yards are now being built, requiring a total expenditure of $40,000,000. This project was described in detail and illustrated in the issue of May 23, page 1121.

The Problem of Railway Valuation.—The change in the public's attitude toward the railways and the problems connected with the making of a fair valuation were discussed by Logan G. McPherson, director of the Bureau of Railway Economics, in the issue of May 23, page 1131.

Plans for New Union Station at Chicago.—The plans for the proposed new passenger terminal for the Pennsylvania, Burlington, St. Paul and Alton at Chicago, as presented by the railways, were described in the issue of May 23, page 1147.

Canadian Pacific Coal Unloading Dock.—A new dock for the unloading of coal from lake boats onto storage piles or cars, similar in design to the more recent ore unloading plants, has recently been completed at Fort William, Ont. This dock was described May 30, page 1173.

Relocating the Chicago Railway Terminals.—The Chicago Plan Commission, appointed by the mayor to study the terminal situation, has prepared a plan providing for the location of passenger and freight terminals along Twelfth street. This plan was described and illustrated in the issue of May 30, page 1184.

Grand Trunk Grade Separation in Toronto.—The Grand Trunk is now engaged in the work of separating its grades in Toronto, Ont. This project will also involve the construction of a new union station and is divided into three sections, the first of which is now practically completed. This work was described and illustrated in the issue of June 6, page 1213.

New Extension of the Norfolk Southern.—The consolidation of a number of lines to form the Norfolk Southern has been further augmented by the extension to Charlotte, N. C., giving it a direct through line from Charlotte to Norfolk. A number of interesting construction problems were presented in this work and were described and illustrated in the issue of June 13, page 1315.

Thirty Mile Electrification on Norfolk & Western.—The Norfolk & Western has recently authorized the electrification of a 30 mile section of its main line between Bluefield, W. Va., and Vivian, to handle a very heavy coal traffic over the mountains. The general details of this work were given in the issue of June 13, page 1319.

Doubling the Load Capacity of an Old Iron Railroad Viaduct.—An interesting method of strengthening an old iron viaduct on the Pere Marquette by the addition of reinforcing trusses and center posts, was described in a paper by W. T. Curtis, presented before the Western Society of Engineers and abstracted in the issue of June 13, page 1323.

New Yards of the Chicago & Alton near Chicago.—The Chicago & Alton is now engaged in the construction of a new yard and engine facilities at Glenn, Ill., about 10 miles southwest of Chicago. A number of interesting features in the design of this yard and buildings were described and illustrated in the issue of June 13, page 1327.

TRACK SCALE SPECIFICATIONS AND RULES.

Recommendations Adopted by the American Railway Association Provide a Standard to Which Railroads Can Work.

The following recommendations were adopted by the American Railway Association at its session in New York on May 21, with the view of setting an ultimate standard towards which railroads generally may work, but are not intended to condemn scales, methods of installation or reinstallation, etc., now in service, which come within the sensibility and tolerance prescribed in section 4 and respond to the tests as prescribed in section 12 below. These specifications and rules are also not intended to cover installations for special weighing such as twin loads, etc.

SELECTION, INSTALLATION AND LOCATION OF NEW SCALES.

1. When selecting track scales, the following should be considered:

(a) Maximum loads to be moved over scale for weighing or otherwise, considering the spacing of and the concentration of weight on axles.

(b) Length of wheel base of cars or other equipment to be weighed.

(c) Whether cars are to be weighed, spotted or in motion.

2. When track scales are to be installed, consideration should be given to:

(a) Location with respect to yard work and grade.

(b) Character of foundations.

(c) Method of installation.

(d) Drainage, lighting, heating, ventilation.

3. Having the above information, the three essentials of a track scale are:

Design, capacity and length.

4. SCALE DESIGN.

(a) Scales should be so designed that the load is suspended from (and not superimposed on) the main supporting levers, unless intermediate means are provided between the bridge supports and the bearings to absorb the oscillations and prevent the displacement of the bearings at points of contact on the knife-edges.

(b) They should be constructed in four sections with vital parts as accessible for cleaning and inspection as practicable.

(c) Practical means of adjustment should be provided to secure uniform distribution of load on the scale at points of support.

(d) Parts of the same type of scale should be of uniform dimensions and interchangeable as far as practicable. The position of each nose iron should be clearly indicated by a well-defined mark, showing its position when the lever is sealed.

(e) Scale design which contemplates the use of check rods should be checked longitudinally and transversely, preferably at the point of least resistance.

(f) Beams should be so designed as to weigh all loads on main and fractional bars without use of hanger weights. The main bar of the beam should have not more than six notches to the inch, assuming each notch to represent 1,000 pounds. Fractional bar should be graduated to 50 lb. subdivisions, with not more than four subdivisions to the inch, which would correspond to 200 lbs. per inch. A shoulder stop must be provided on all beams to prevent the poise traveling back of the zero graduation. Where the scale is not equipped with a full capacity beam, the maximum capacity must be clearly and permanently placed on the scale where it can be easily seen.

(g) Multiplication at butt of beam should not exceed 800 to 1. High multiplication in levers is undesirable.

(h) Type-registering beams should be used where spot weighing is performed.

(i) The sensibility reciprocal is the weight required to move the beam a definite amount from pointer or other indicating device of a scale. In scales provided with a beam and trig loop the sensibility reciprocal is the added weight required to be placed upon the platform to break and turn the beam from a horizontal position in the middle of the loop to a position of equilibrium at the top of the loop. This may be determined by subtracting the weight instead of adding it, or by using the sliding poise on the beam, if this is done without jarring the beam.

For railroad track scales the angular movement or play should be 2 per cent. and the sensibility should correspond to 1 per cent. angular movement of the beam.

The sensibility reciprocal of a track scale should never be greater than 100 lbs., and when the scale is new should be not greater than 50 lbs., that is, a load of 50 lbs., when applied to the scale platform, should cause the beam to move from a position in the middle of the trig loop to the top of the loop. For verification purposes when new, a scale should be capable of adjustment to within 1/2000 (one-half pound to the thousand pounds) of the capacity, and should be considered inaccurate after it cannot be maintained in adjustment to within four pounds to the thousand pounds, in excess or recess. Track scales should be kept in the closest possible adjustment.

(j) Bearings, wherever practicable, should be compensating to insure full length contact of pivots with bearings.

(k) Friction in all parts of the suspension should be reduced to a minimum by providing hardened steel contacts, and the design of scales should contemplate this important factor.

5. CAPACITY.

In determining the sustaining capacity of the scale, there is still a diversity of opinion among the best scale engineers as to the better method of procedure, and it is true that in figuring the scale levers the prime factor is to figure for deflection, which may necessitate deviating from standard engineering practices somewhat. It matters not if we assume a very small fiber stress neglecting the impact or assume a higher fibre stress and add a percentage for impact.

As a basis of calculation from an analytical point of view it seems quite natural to first assume the capacity of the scale and then proportion the amount beyond that which will apparently eliminate deflections, and we here approach what may be determined an undeveloped state in the higher art of scale building at this time.

One of the most logical ways of arriving at a conclusion would be to take the maximum weight on a pair of wheels (whether they be cars or locomotives), which at present is about 65,000 lbs., located on a transverse center line of main levers, plus the dead load divided by the number of supporting knife-edges. The above may be expressed in the shape of a formula, as follows:

w = Dead load.

a = Maximum weight on a pair of wheels.

n = Number of supporting knife-edges.

$$\text{or maximum load} = q = \frac{w}{n} + a.$$

The load "q," which is applied to both main levers of each section at the points of load support, is distributed as follows:

1. Main Levers. Maximum load "q" at point of load application.

2. End Extension Levers. A percentage of "q" based on the multiplication of the main lever.

3. Middle Extension Levers. A percentage of "q" based on the multiplication of the main lever and the reaction of the end extension lever.

4. Fifth Lever. The combined reaction from the two middle extension levers.

By taking these loads at their respective points of application,

the moments can be determined and the size of cross-section computed according to the stresses recommended.

Levers. The design of levers, and the classes under which they appear should be governed by the use of such sections, that under the load or weight determined from the capacity, the deflections and stresses are within the limits specified.

Stress—
Cast iron, tension .....2,500 lbs. per sq. in.
Cast iron, compression .....5,000 lbs. per sq. in.
Cast steel, tension .....8,000 lbs. per sq. in.
Cast steel, compression .....8,000 lbs. per sq. in.
Maximum deflection—
Cast iron .....0.040 in.
Cast steel .....0.080 in.

Loops. All loops should be so designed that the respective strengths are equal to those of the pivots, the latter being the basis for calculation. The combined stress in tension due to flexure plus direct tension should not exceed 8,000 lbs. per sq. in.

Pivots. All knife-edges, pivots, and bearing surfaces for same should be made from a steel which possesses such properties as will insure a maximum toughness combined with the necessary degree of hardness to insure minimum wear under maximum loads. The following physical properties, based on steel with the internal strains relieved by drawing after hardening, should be as follows:

Ultimate tensile strength.....200,000 lbs. per sq. in.
Elastic limit .....165,000 lbs. per sq. in.
Elongation in 2 in.....5 per cent.
Reduction in area .....25 per cent.
Maximum working stress .....20,000 lbs. per sq. in.

Application of load and method to be followed in determining the cross-section, based on the stress specified:

In determining the bending moment, the lever-arm "L" should be defined as half the length of the bearing surface in the loop or connection, plus ¼ in., plus the difference between the dimensions of the friction faces in the loop and the friction faces on the lever, as expressed in the following formula:

Let L = Lever arm required.

I = Bearing surface in loop.

T = Distance between friction faces of loop.

W = Width of boss or sustaining member enveloping pivot.

Then:

$L = \frac{1}{2} I + (T - W) + \frac{1}{4}$ in.

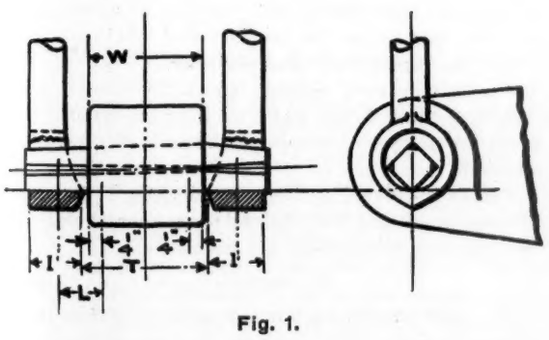


Fig. 1.

(i) The bearing per lineal inch of knife-edge should not exceed 7,000 lbs. when the hereinbefore mentioned loading is considered.

Structural steel used in connection with the installation of scales shall be properly braced, including diagonal stays, if necessary, and should conform to steel structures furnished by the American Railway Engineering Association.

6. LENGTH.

(a) The length of scales should be considered as the distance between ends of scale rail.

(b) The ends of scale rails should not project beyond the knife-edges of the end main levers.

(c) When cars are to be weighed spotted, the scale should be of sufficient length to place the entire car on the scale and preferably longer to facilitate spotting.

(d) When the cars are to be weighed in motion, cut at both ends at a speed not to exceed four miles per hour, the scale should be approximately 1/3 longer than the wheel-base of the longest cars ordinarily weighed. Humps for gravity weighing should be so constructed that cars with wheel-bases longer in comparison to scales should pass over scales at a slower rate of speed or be spotted if necessary.

7. LOCATION.

The proper location of scale depends principally on the following conditions:

(a) The volume of traffic to be weighed in comparison with that switched over the scales and not to be weighed.

(b) Whether scale is to be equipped with dead rail or relieving gear.

(c) Whether run-around track will be installed for switching with a separate track for weighing.

(d) Whether cars are to be weighed spotted or in motion.

(e) The cost of extra switching, when the scales are not located on a lead to classification track.

(f) Cost of maintenance when scale is located on lead to classification track and only a small proportion of cars are to be weighed.

(g) The necessity for quick despatch of cars that are weighed.

So much depends on local conditions affecting the different carriers that it would be difficult to give exact rules in connection with the above suggestions. It is recommended, however, that there be not less than 50 ft. of tangent track at both ends of scale rail. When only a small proportion of the cars handled are to be weighed the rails leaving the scale in the direction of weighing may be curved and the dead rail straight, or the curvature may be equalized between them.

8. GRADE.

(a) When the scales are located on a lead to classification tracks in hump yards they shall be at a sufficient elevation that cars will run by gravity as far as desired into the classification yard, considering a maximum speed of four miles per hour over the scales.

(b) When scales are not located on the hump, they should be at a sufficient elevation to provide the necessary grade on the track leaving the scale in the direction of weighing that the usual cut of cars to be weighed will run away from the scale by gravity in order to prevent impacts on the scale.

(c) The length of the hump and the grade thereon should be such that free running cars as above will pass over the scales at a speed not to exceed four miles per hour without brake application.

(d) Where it is the practice for one car rider to take several cars together into the classification track, the same grade as on the scale should be maintained for at least 100 and preferably 200 ft. beyond the scale in the direction of weighing so that cars may be stopped easily by the car rider and so that succeeding cars will not cause excessive impact when striking the car ahead which should occur not less than one car length from the scale.

9. FOUNDATIONS.

(a) Scale foundations should be constructed of concrete or cut stone. When the latter material is used it should be laid in cement mortar.

(b) Foundations should be constructed in accordance with the best engineering practice.

(c) Piers or parts of foundations supporting scale stands or the rail system should be of sufficient area that the pressure per square inch in accordance with the best engineering practice will not be exceeded and must be constructed as nearly as possible to exact elevations. Grouting is undesirable. The tops of piers or supporting walls should be finished with a layer of cement mortar in the proportion of one to one to the depth of approximately 1½ in. and after setting dressed to exact elevations.

(e) Where necessary to prevent seepage of water through foundations into the scale pit, they should be water-proofed and drained into a water-proofed cistern located outside of the scale

pit, and equipped with either hand pump, air siphon, or steam siphon.

(f) Drainage should be provided in all cases where there is a possibility of water getting into the pit and where excessive seepage is not present and there is sufficient fall, pipe drainage should be used.

(g) The minimum period of ten days should elapse between the placing of the last concrete and the putting of the scale in service to permit proper setting of the concrete. The proper setting will be influenced by the prevailing temperature and weather conditions during that period, and this should be given due consideration.

10. INSTALLATION.

(a) Scales should be installed with dead rail or relieving apparatus.

(b) The deck or platform should be of the rigid type, so that the balance of the beam is not affected by weather conditions, etc. It should be made as nearly dirt and water proof as possible.

(c) Scales to be used for spot weighing should be constructed with scale rails level and approach rails level with scale rails for a distance of 50 ft.

(d) Scales to be used for motion weighing should be constructed with scale rails at not greater than one per cent. grade.

(e) Wedge or other means of adjustment used between bridge and scale supports to secure uniform distribution of loading should be set as low as possible when scales are installed, as future lining usually requires raising the bridge rather than lowering it. The end of the check rod on scale should be ¼ in. higher than at point of anchorage.

(f) Material such as wooden ties, placed between the bridge and scale rail, will absorb the shock and protect the vitals in case of derailment. This should not be framed until the bridge is installed in order to secure proper elevation of the scale rails and should be fastened securely to the bridge to prevent shifting.

(g) Scale should be set directly on foundations or on metal bed plates resting on foundations.

(h) Scale parts, where necessary, should be securely anchored to foundations, and it is desirable that means of slight adjustment longitudinally and transversely be provided for properly setting scale, interchanging scales in the same pit, etc., in order to secure perfect freedom of action for all parts in suspension.

(i) Scale beam supports should rest directly on scale foundation.

(j) The use of extension levers between the fifth lever and scale beam is undesirable.

(k) Scales and structural steel should be cleaned and painted with one coat of red lead paint before being installed, one coat after installation and at such other times as may be necessary.

(l) Minimum clearance for the working of scale parts through or about parts of installation not connected with scales, should not be less than ¾ in., except that when scale end approach rails are securely anchored a clearance of not less than ½ in. will be permitted.

(m) Open hearth scale rails of full length and sufficient capacity for supporting the load are desirable.

(an) An efficient transfer rail, or other connection, may be used to prevent impact of cars moving over joint between approach and scale rails, such contrivance to be so designed as not to interfere with the action of scale.

(o) Approach and scale rails should be anchored to prevent creeping and should be maintained in proper line and surface.

(p) Scale pits should be heated wherever practicable and necessary to prevent freezing and rust.

(q) Effective means should be provided for ventilating the scale pit where practicable. Openings in side walls are desirable. Means should be provided for closing such opening when there is possibility of wind pressure affecting the scale when weighing.

(r) Scale pits should be properly lighted for purposes of cleaning, inspection and testing.

(s) Scale houses should be constructed at track scales for proper housing and protection of scale beam and protection of weighmaster.

(t) The interior and exterior of scale houses should be amply and properly lighted to afford proper facilities for weighing and the prevention of mistakes in reading scale beam, car numbers and stenciled light weights. This applies more especially where cars are weighed at night.

11. MAINTENANCE AND OPERATION.

(a) All track scales should be numbered and referred to by number and location.

(b) Extensive repairs to scales, such as renewal of or sharpening of pivots, should be made in properly appointed shop.

(c) When scales are in service regularly, scale parts, substructure and foundations should be cleaned at least twice a month, and, when exposed to the elements, or otherwise located so that they are liable to become clogged with ice or dirt, should be cleaned as frequently as necessary.

(d) The application of rust preventives to bearings is desirable, but they should be so applied as not to interfere with the proper working of the scale.

(e) If ice obstructs the levers, salt should not be used to melt it; artificial heat should be used wherever practicable.

(f) Equipment should not be allowed to stand on the scales except when being weighed.

(g) Engines or other equipment not to be weighed should be passed over the dead rail, except on authority of the weighing department.

(h) Cars should not be bumped off scales by an engine or another car on the dead rail, nor be pulled across the scale coupled to another car moving over the dead rail.

(i) Enginemen should not apply sand to scale or dead rail, nor should the injector on the engine be applied when the engine is standing on or passing over the scale.

(j) The weighing beam should be balanced before the scale is used and when not in use should be locked with the beam catch.

(k) Cars should not be violently stopped on the scale by impact, by the sudden application of brakes or by throwing obstructions under the wheels. When pushing off scale cars which have been stopped for weighing or otherwise, impact must not occur at a speed greater than two miles per hour. When necessary for any reason to run cars over the scale rails, the speed must not exceed four miles per hour.

(l) The weighmaster should familiarize himself with the construction of the scale and make such inspections at such intervals as are necessary to determine if the scale is in proper working condition.

(m) Parties appointed to inspect and clean scales should be properly instructed, and it is desirable that they be present with the scale inspector when scales are tested.

12. TESTING.

(a) The standards of mass for testing scales should be derived from primary weights, verified by the National Bureau of Standards, Washington, D. C., to within what is known as their "Class B Tolerance." Such weights can be obtained either direct or through scale manufacturers. The 50 lb. secondary or working cast iron weights, which are transported from place to place and used directly in testing scales, should be rectangular, and of such design as to facilitate stacking; they should be free from pockets, blow holes, etc., which are liable to catch and hold foreign matter. No adjusting cavity or cavities in the bottom of the weights should be permitted.

These weights should be tested and adjusted in comparison with the master-weight, which has been verified to within "Class C Tolerance." The working weights shall be adjusted to within 25 gr., and maintained to within 100 gr. of their true values.*

(b) Scales in regular service shall be tested at least every three months with a test car or test weights up to at least ten per cent. of their rated capacity.

(c) Scales should be given a graduated test up to their work-

ing capacity when installed and periodically thereafter. The necessity for the frequency of such a test depends on the design, capacity and method of installation of the scale used, the wear of scale pivots, and the amount of weighing performed.

(d) A test shall be made each week by weighing a heavily loaded freight car with as short a wheel base as is obtainable, on each end and the center of scales. When a scale is equipped with an automatic weighing attachment, the car should, in addition to the above, be weighed spotted on the trip end of the scale and in motion with the automatic attachment connected. A report of these tests should be sent to officer in charge of scales and weighing.

(e) In addition to the above a daily test should also be made on each scale equipped with an automatic attachment, by weighing a car spotted on the trip end of the scale with beam, also in motion with the automatic attachment connected. A book record of this and other tests is to be kept by weighmaster.

13. EQUIPMENT FOR TESTING.

It is desirable for verifying or sealing test weights and test cars to have, in addition to standards of mass prescribed above:

(a) An accurate even arm balance of 100 lbs. capacity in each pan, sensitive when loaded to two grains.

(b) A master scale of sufficient length and capacity for scaling test cars, sensitive to within 5 lbs. in 50,000, should be installed under cover and properly maintained and tested to insure accuracy.

(c) For the proper design of scale test cars consideration should be given to the following:

(d) All metal construction.

(e) Length of wheel base.

(f) Uniform distribution of load on axles.

(g) The elimination as far as practicable of ledges or projections likely to catch and hold dirt.

(h) The elimination of all unnecessary parts.

(i) Strength and durability so that frequent repairs will not be necessary.

(j) Surface area to be reduced as much as possible to limit wind pressure.

(k) The accessibility of all parts for inspection.

(l) The ease with which it may be barred or moved by scale inspector.

(m) Weight of car and weight of super-cargo if used.

NOTE.—There is a wide variation of practice in regard to the design of scale test cars. It is thought, however, that the majority of cars weigh from 30,000 to 60,000 lbs., and have a wheel base of from 6 ft. to 8 ft. Some have a body made up of solid castings with space provided for a small super-cargo; others have a body of plate steel with space for super-cargo or test weights, weighing about as much as the car. Local requirements principally determine the type of construction to be followed. It is not thought, however, desirable to have test car weigh less than 30,000 lbs., nor greater than 60,000 lbs., for general testing. Heavier cars on two axles up to 80,000 lbs., are desirable for use in making graduated tests up to the capacity of the scales or the capacity of loads to be weighed.

NOTE.—The standards for testing scales in the Rupublic of Mexico must be in accordance with the metric system standards and will be verified by a federal scale inspector in accordance with the federal laws.

14. AUTOMATIC WEIGHING AND RECORDING DEVICES.

Efficient automatic weighing and recording devices may be used where desired. There has been, in the past, however, and may be at present, an impression, by some, that the automatic weigher and recorder will overcome all outside influence and give correct results regardless of scale and track conditions and the speed at which the cars are handled over the scale. This is an erroneous impression as it is absolutely necessary that the scale and the automatic device as well be in first class condition with properly maintained approach tracks and cars must be run at a slow rate of speed with particular attention to steadiness of motion if best results are to be obtained.

NEW BRANCH LINE FOR INDIA.—A branch line, 8.58 miles long of the 3 ft. 3 in. gage has been sanctioned from Nidamangalam, on the South Indian Railway, to Mannargudi; to be constructed on behalf of the District Board of Tanjore.

NEW FORMS OF STEEL SHEET PILING.

The use of steel sheet piling for cofferdam work has become quite general in recent years, and a number of forms of such piling have been placed on the market. The Lackawanna Steel Company, Buffalo, N. Y., manufactures sheet piling in a number of different designs for various purposes and has recently added to these designs two new ones: the arched web piling and the concrete protective piling.

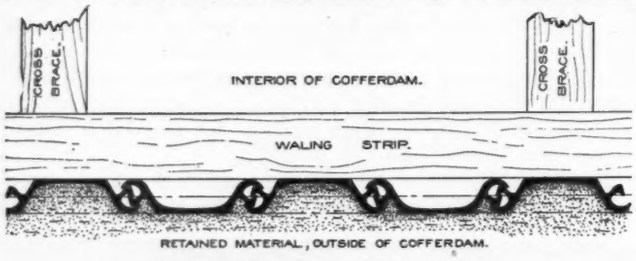
The arched web design differs from the straight web type in the fact that the web is curved or arched so that the entire web lies to one side of the neutral axis. The outer side of this arch is flattened to lie in the same vertical plane as the extreme edge of the interlock, this flat face furnishing a large bearing area for waling strips used for internal bracing. This type of piling is recommended where transverse or beam strength is required and for such location the section is very effective as it has a decidedly higher section modulus for a given weight of section than the straight web piling.

The protected steel piling consists of any of the standard sections coated with concrete which is mechanically bonded to the

Lackawanna Protected Steel Sheet Piling.

steel piling. These combination piles are designed for use in permanent structures in which the use of exposed steel would be objectionable on account of the rapid corrosion that would take place due to the intermittent wetting of the steel surface or from the chemical action of acids contained in the materials in contact with the piling. The piles are encased in concrete before driving; the facing being so mechanically and adhesively bonded to the pile as to permit its driving with the concrete facing attached. The lower ends of the piles for a length of 6 in. are left exposed to serve as a cutting edge and the lower end of the concrete facing is tapered to facilitate driving. The tops of the piles for a length of 6 in. are also left exposed to receive the blows of the driver. The portion of the piles below the ground surface need not be protected if they are coated with a good preservative. If it is desired, the piles thus protected can be completely driven and the upper portion can then be encased in concrete by the use of removable forms, the same bonded wires being used as in cases where they are encased before driving. A great number of combinations of steel sections can be secured in these protective pilings, and if desired, two or more piles may be encased together to form solid slabs

which may be driven as a single unit. When the piles are encased before driving the section is so designed that the interlocking portion of the steel bonding can act in the same manner as in the uncoated piles; the pockets in the interlock and between the faces of the concrete coating being filled with grout after the wall is driven. The mechanical bond is secured in the case of center flange piles by inserting reinforcing rods through holes drilled in these center flanges. In the straight web and arch web sections, rectangular bars are placed through rectangular holes in the web, the bars having holes near their ends for the insertion of the bonding bars. The entire thickness of the coated piles is either 9 in. or 12 in., as desired. These piles can also be made for any desired angle or bend, and can



Arched Web Steel Sheet Piling.

be driven to form circular structures without any radical change in the design.

The principal use for such protected piling is for sea walls or retaining walls built on soft material which would otherwise call for submarine foundations of timber or stone. For walls where it is necessary that adjacent structures be protected from disturbance which would be involved in the building of large foundations and where quick action is required in the construction or repair of permanent foundations requiring strong and impervious walls. An installation of these protective piles requires no subfoundation, no sub-aqueous foundation nor rip rap along the outer face to protect against the action of waves or tides. A number of suggested designs for shore revetments, dikes, bulkheads, levees, docks, sea walls and piers have been worked out by the Lackawanna Steel Company, as well as the complete details for the forms used in encasing the steel piles.

THE PRESERVATIVE TREATMENT OF RED-OAK AND HARD-MAPLE CROSSTIES.

Much has been published upon the durability of railway ties treated by various preservative processes, but there is little available information concerning ties treated by different processes and laid in one track, where the treatments can be compared. In order to gather data for such a comparison the Forest Service of the Department of Agriculture, through its Forest Products Laboratory, in co-operation with the University of Wisconsin and the Chicago, Milwaukee & St. Paul, has completed the first stage of an extensive experiment, the purpose and scope of which are given in Bulletin 126 of the Forest Service, recently issued. The ties used in the experiment were ordinary stock of the co-operating railroad, and 100 of each of the two species, red-oak and hard-maple, were treated by each of six processes, selected so as to include at least one from each general type of pressure processes in common use. Thus, there were treated for the experiment 600 red-oak and 600 hard-maple ties, and 100 untreated ties of each species were laid. The history of each tie up to the time of laying is recorded, the preservative processes described, the methods of handling and laying given in detail, and everything needful for comparison of results of future inspection carefully worked out.

In selecting a location for the test track the effort was to secure normal conditions of site and traffic. The location is on a single track road which carries a fairly heavy traffic in both directions. The track at the point where the ties are laid is gravel ballasted, well drained, straight and practically level. Nearly all the treated ties are placed on a fill, but a few included in the test were laid in a cut.

Screw spikes with flat tie-plates were used on 50 per cent. of the ties and the remaining 50 per cent., unprotected by tie-plates, were fastened by ordinary cut spikes. An extension to the original experiment included red-oak and chestnut ties treated by a commercial plant, and a few spruce ties contributed by another firm were used. In order to avoid disturbing the track in the future, new rails were laid at the time the ties were placed, and new fastenings were used throughout.

It is thought that a series of observations and inspections covering several years will yield valuable information relative to the preservation of timber and its behavior in actual use. The bulletin is illustrated with reproductions of drawings and photographs of apparatus and material, and all details as to ties are given in tabular form.

THE FOREMAN PROBLEM—HOW TO PROVIDE A SUPPLY FOR THE FUTURE.*

By L. W. Strayer,
M. of W. Department, B. & O., Pittsburgh, Pa.

The criterion of a good roadmaster is his ability to build an organization of foremen about him, to efficiently and economically conduct the maintenance on his territory. Track foremen are made and not born. They should have at least an ordinary common school education, be skilled in track work, have foresight and be capable of meeting all emergencies that arise. In order to develop foremen, we must begin with the track laborer and familiarize him with the work and standard practices of maintenance. Generally the plan of increasing wages to attract a more intelligent class of men and educating those who show a disposition for advancement, will produce results. In the rural districts, mountain divisions, on branch lines of our railways and on some trunk lines that traverse the middle western agricultural belt, there are American trackmen who can be worked into foremen. If we could develop all this talent and use it wherever we need new foremen, our problem would be much easier. Some of these men, however, are averse to handling foreign labor, others shun promotion for lack of initiative, still others have family connections or perhaps some property that holds them to a certain place and they will work at lower wages rather than be transferred to a strange community.

There should be a leading laborer or assistant foreman to each section at an increased rate of 15 or 20 cents a day, this man to act as foreman in the absence of the regular one. The most promising of these assistants can be used as assistant foremen on extra gangs during the summer months. In this way one can develop men and at the same time stimulate a rivalry for the promotions as they are bound to come. This method should be supplemented by keeping not less than four men and a foreman to each section regularly, these men to be paid an increase over the ordinary extra gang and temporary section men. Such places would be permanent ones and at a premium. The efficiency of such a class of skilled trackmen would easily cover the increased rate of pay, attract a better grade of men and eventually produce better foremen. This scheme is being successfully carried on locally in several instances.

Another phase of the problem is to educate the best of the foreign element, in and near the industrial centers, for scarcely any men of American birth can be found doing track work in a vicinity where other employment can be had. By a little timely observation and instruction, the best laborers can be picked out and made leading laborers, then assistant foremen of extra gangs for a season or two, during which time they should be encouraged to attend night schools, or instruction should be furnished by the railway company in order to teach them to read

*Received in the contest on The Section Foreman Problem, which closed March 25, 1912.

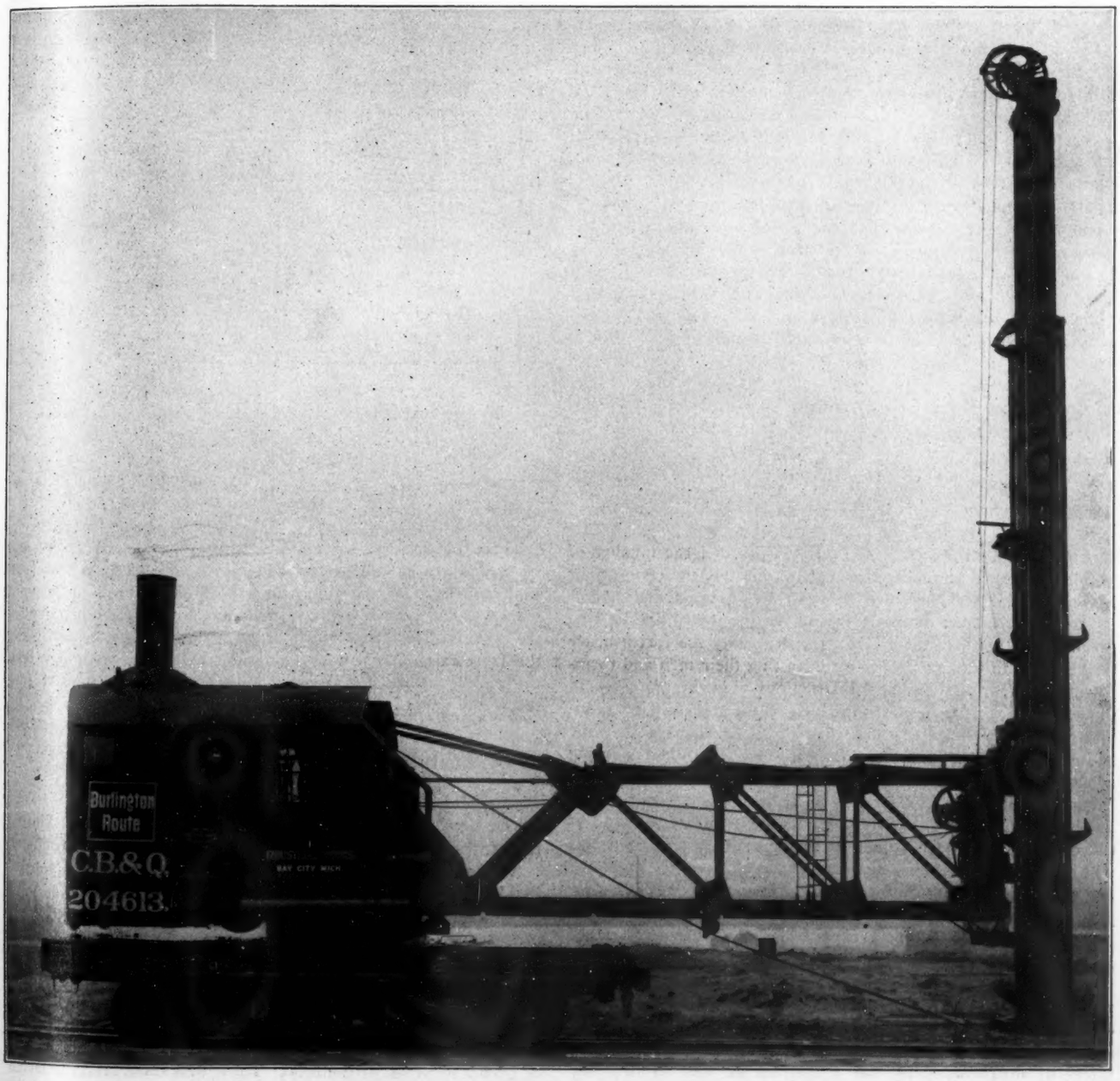
and write the English language and the rudiments of bookkeeping, so they can handle the reports required of them as section foremen. Anyone in close touch with foreigners realizes that they are quick to learn. I have found them eager to advance themselves if some one will take the time to direct and encourage their efforts. Once they become foremen, they are likely to settle down and their efforts are an asset to their employers.

In the South, where negro labor is used largely, there is practically no opportunity to recruit foremen from trackmen. The railways in the Southwest have been having success with Mexicans and some Indians during the past years, especially so as sectionmen, but for the most part they are not aggressive enough to promise much as future foremen. Japanese and some Chinese on the Pacific coast do not offer much in any grade above that of laboring men. On most all the roads foremen are of American birth, with some Italians. It is necessary therefore to develop foremen in the favorable localities and transfer them at an increase of salary sufficient to meet the conditions.

It is possible since the introduction of automatic track circuit signals, interlocking plants and other signal devices that the maintenance forces can be combined under one foreman's supervision. This is practical on territory subjected to heavy traffic, where several departments patrol the same sections to inspect and make minor repairs. In such a combination we could draw on any of the various departments for a foreman and get a broader man, at the same time eliminating the friction between departments. Such an organization has been successfully tried out locally, in a small way, so that several trunk lines are contemplating such a move where traffic is heavy. It seems very reasonable to predict that such a maintenance organization will work out and in the end be a decided improvement over the present system. If such can be made a universal success, we have our foremen problem solved.

A CONVERTIBLE LOCOMOTIVE CRANE PILE DRIVER.

A combination locomotive crane and pile driver has recently been developed by the Industrial Works, Bay City, Mich., for the use of railroads and contractors requiring a pile driver only a portion of the time. As shown in the photograph, this is not a crane with leaders suspended from the boom, but is a com-



New Convertible Locomotive Crane Pile Driver.

plete pile driver with a built-up leader truss, a battering attachment and regular leaders. Ordinary locomotive cranes are frequently equipped with steam hammers, either with or without leaders, and good results are obtained where the service is not too severe or where it is not necessary to drive the piles on a batter. However, such a combination is not sufficiently rigid to be able to force into position and hold upright while driving, a pile that is not inclined to drive straight. It is to overcome these objections that this new driver has been designed.

The construction of this machine does not differ in any important detail from that of a regular 30-ton crane. The 24-ft. car is built entirely of steel and is equipped with standard draft rigging, complete air brake equipment and telescopic outriggers. A boiler of large steam capacity is provided to meet the demands of varying conditions of service. All of the important castings are of steel and all of the gears are either of cast steel or bronze. The operations and functions are the usual ones of a locomotive crane, making it available for use with a hook, lifting magnet, grab bucket, etc.

As a pile driver, the distinctive feature is the leader truss, which is easily substituted in the place of the regular crane boom. This truss is constructed of structural shapes and is fastened to the crane by a steel pin and tension rods. At the outer end is provided the support for the leaders and the battering attachment. The leaders are self supporting and are of all steel construction similar to those on ordinary pile drivers but correspondingly lighter. All of the operating movements are power driven, it being possible to raise or lower the leaders in a few seconds. The adjustment for battering is made by hand by means of a crank and gearing.

This machine will drive piles 29 ft. either side of the center of the track or 21 ft. ahead of the wheel base without the use of outriggers or blocking, and because of the full circle swing it will work equally well at either end of the car. The machine shown is a 30-ton crane built for the Chicago, Burlington & Quincy. Similar arrangements can also be provided on the larger size cranes, thus making them available for a greater variety of service.

DETAILED SUPERVISION ESSENTIAL TO SAFETY OF MEN.*

By G. R. Talcott,
Assistant Division Engineer, Baltimore & Ohio, Baltimore, Md.

Although it is not generally considered that the risk of personal injury is great in maintenance of way work, a large number of accidents occur which are primarily due to carelessness or ignorance, and are, therefore, preventable. General instructions covering the conduct of employees do not accomplish the desired result unless the men themselves, and especially the foremen, are impressed with the importance of protecting their men and themselves from personal injury. Instructions requiring foremen to blow a shrill whistle to notify the men of the approach of trains, and requiring the men to stand clear of all running tracks while trains are passing, have brought good results. When working around yards and terminals, constant vigilance on the part of the foreman is necessary and in addition to giving a warning signal, he should each time designate the place the men are to stand in the clear, and the men should thoroughly understand that this will be done. A foreman's qualifications in this respect should be one of the important considerations governing his selection for yard and terminal work.

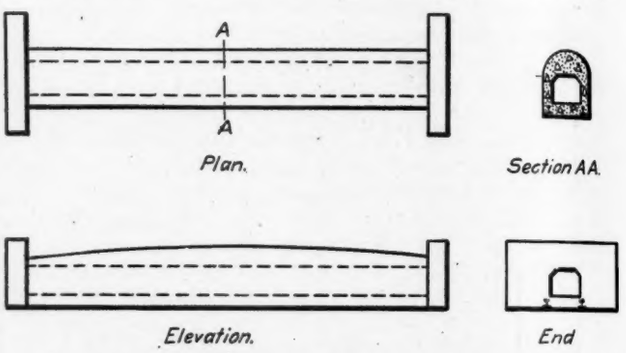
The use of worn out or broken tools causes accidents which are entirely preventable. The use of such tools is not desirable from any point of view, and the men should be encouraged to report such defects to the foreman as soon as discovered. The elimination of dangerous physical conditions along the road is an important part of a general safety movement, and increases the safety of maintenance of way employees as well as of other employees and the public. While the introduction of special devices and appliances will promote safety in specific cases, the greatest good is to be accomplished by education, which can best be attained by periodical meetings of the division engineer or roadmaster, as the case may be, with the supervisors, followed by meetings of the supervisors with the foremen. These meetings need not be safety meetings primarily, but for the discussion of all matters pertaining to the work with safety as a subject to be reported on. When once an interest is aroused, numbers of small risks taken by the men will become apparent which would otherwise escape notice until an accident resulted.

*Received in the Safety contest which closed October 25, 1912.

A SMALL MONOLITHIC CULVERT.

By C. T. Musgrave,
General Foreman, Bridges and Buildings, Oregon Short Line, Idaho Falls, Idaho.

The accompanying plan shows a type of culvert which has been built in several instances on the Montana division of the Oregon Short Line. This culvert is built monolithic, with two scrap rails in the lower corners for reinforcement. Where the inside width does not exceed 20 in. a culvert of this kind can be put in without stopping traffic, as it is not necessary to take out more than one tie, and the excavating can be done, the concrete poured and covered over, and the tie replaced in a few hours. A wooden form was used for these culverts, in which the bracing could be knocked out with a long pole, allowing the sides to collapse. The estimated cost for such a culvert 22 ft. long with end walls was $100.



Small Monolithic Concrete Box on Oregon Short Line.

Three of these culverts have now been in service over two years and are still in perfect condition. One of them was built in a swamp with the top within 2 ft. of the rail at a point where it has been difficult to maintain any kind of pipe under the pounding of trains which drove it down in the center while the frost raised the ends. This culvert replaced a timber box, the middle of which has been driven down more than a foot below the ends.

TEN STATES PRODUCE BULK OF PORTLAND CEMENT.

The production of Portland cement in 1912 in the United States was 82,438,096 barrels. This production was reported from twenty-four states, the first ten states, namely, Pennsylvania, Indiana, California, New York, Missouri, Illinois, New Jersey, Michigan, Iowa and Kansas given in the order of their importance reported 69,682,321 barrels, or about 85 per cent. of the total. These states ranged in production from 26,441,338 barrels in Pennsylvania, or over 32 per cent., to 3,225,040 barrels in Kansas, or about 4 per cent. of the total. Indiana, the second largest producing state, reported 9,924,124 barrels, or 12 per cent., and California, the third state, reported 5,974,299 barrels or over 7 per cent. of the total. These first three states reported over one-half of the total production.

NEW TIMBER TREATING PLANT OF THE B. & O.

A Modern Installation Recently Placed in Service at Green Spring, W. Va. A Number of Original Features Introduced.

By F. J. Angier,

Superintendent of Timber Preservation, Baltimore & Ohio System, Baltimore, Md.

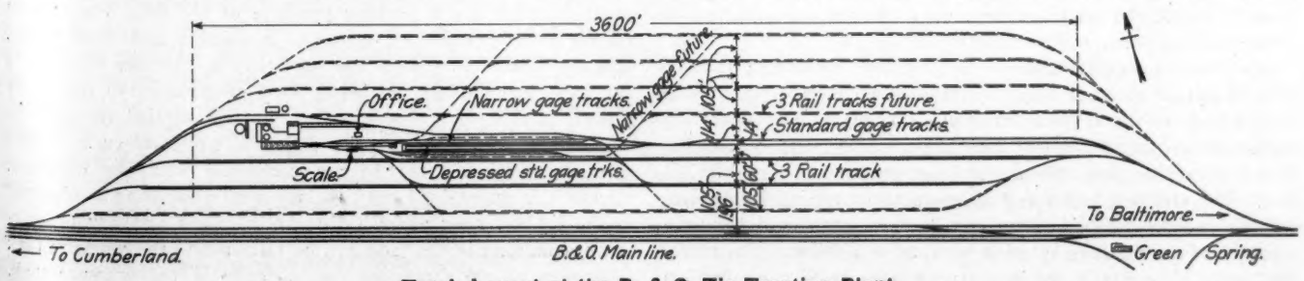
The Baltimore & Ohio has put into operation a new timber treating plant which has just been completed at Green Spring, W. Va., and which is one of the most complete and modern timber treating plants in America. It covers 60 acres and is situated close to large areas of timberland along the South Branch valley of the Potomac river. The requirements of the Baltimore & Ohio system approximate 2,500,000 ties annually for renewals, and with the new plant in operation a large proportion of these ties will be treated by the company. Other timber for railroad use will also be treated here.

The plant is equipped with two cylinders 7 ft. in diameter and 132 ft. long, made of ¾ in. steel and built for a working pressure of 175 lbs. per sq. in. Each of the retorts rests on nine concrete piers and is securely anchored to a center pier with six 1¼ in. bolts. On the remaining eight piers the retort rests on cast steel saddles, and between the saddles and an iron plate imbedded in the concrete are nests of steel rollers, each nest being made of three rollers 2 in. in diameter and 10 in. long.

The retort doors swing on steel rollers and can be opened and closed easily by one man, notwithstanding their weight of 6,400 lbs. each. The doors are steel frames with flanged steel dished heads 1 in. thick. The retorts are equipped with heating coils and also with perforated pipes. The pipes are inserted to obtain a more perfect distribution of steam when green timber is being artificially seasoned as well as for the circulating device used in the Card process.

Track Layout and Tie Yard at New B. & O. Treating Plant.

The main building of the plant is of steel frame construction with corrugatd iron sides and concrete roof. The floors are of concrete and a concrete basement is provided so that should any of the preservative be spilled it can be recovered. In the basement is a concrete sump equipped with an electric device which indicates to the engineer in charge when the sump is filled. The sump is emptied by means of an ejector, the liquid passing into a settling tank about 50 ft. from the building. The settling tank is also of concrete, 20 ft. wide, 50 ft. long and approximately 10 ft. deep. The tank has four compartments, the drain-



Track Layout at the B. & O. Tie Treating Plant.

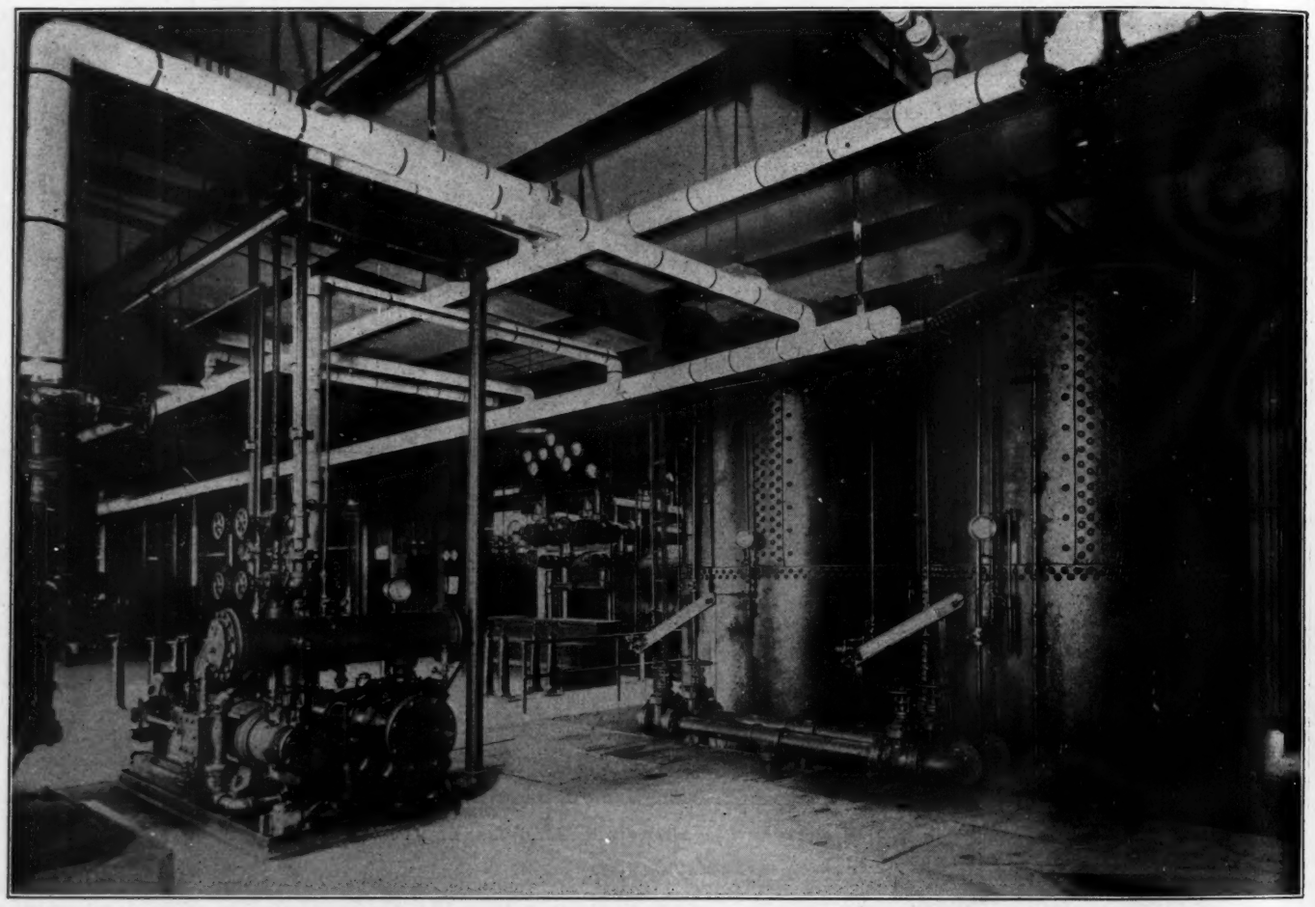
ings from the plant entering one compartment and passing through each of the others in a circuitous path to the last compartment. By this time any creosote carried from the plant falls to the bottom, because of its greater specific gravity, and enters a well in the bottom of the last compartment. Here a bilge pump, operated by electricity, picks it up and carries it to an underground tank from which it is carried into the working tanks by compressed air.

The boiler room is adjacent to the main building, being 30 ft. wide and 40 ft. long. It contains two horizontal return tubular boilers of 150 h. p. each, built for 125 lbs. per sq. in. working pressure, and space is provided for a third boiler to be installed when required. A boiler feed heater, injector and feed water pump complete the equipment in the boiler room.

The oil storage tank is 40 ft. in diameter by 30 ft. high, having a total capacity of 280,000 gal. There is also a storage tank for a concentrated solution of zinc-chloride, which is 15 ft. in diameter by 20 ft. high, with a capacity of 25,000 gal. The oil storage tank is equipped with a system of heating coils made in four sections, the combined heating surface of which is 500 sq. ft. An angle stem thermometer is placed in the side of this tank. to enable the oil to be kept at a constant temperature of about 120 deg. F.

Near the storage tank is an underground unloading tank, 6 ft. in diameter by 60 ft. long, enclosed in a concrete pit, to prevent waste of the creosote if leakage occurs. The tank will withstand an air pressure of 50 lbs. per sq. in., and creosote is forced from this tank into the storage or working tanks by air also. The working tanks and pressure tanks are all located inside the building, so that they can be kept warm and the temperature of the working solution retained at 190 deg. The working tanks are each 24 ft. in diameter and 20 ft. high, with a capacity of 68,000 gal. Each tank is equipped with mercury gages, syphon regulators and dial thermometers. The location of these tanks inside the building also effects a further economy in the consumption of fuel, particularly in cold weather.

The working tanks are 24 ft. in diameter by 20 ft. high, each having a capacity of about 68,000 gal. They rest on concrete foundations 6 ft. above the floor line, being equipped with cast iron radiators for heating the solution. Each tank has three sets of radiators working independently. The combined heating surface of the radiators is 441 sq. ft. Each tank is also equipped with air coils for agitating a mixed solution of creosote and zinc chloride. Air is admitted at 100 lbs. pressure and distributed in such manner as to completely mix the solution in from two to five minutes. The tanks have mercury gages which show the true reading in tub feet and gallons, regardless of the temperature. This avoids the necessity of making correction for temperature readings. Besides the mercury gages each tank has a syphon regulator which regulates the steam supply to the radiators and automatically opens and closes the steam supply valve in maintaining the required temperature.



Interior of Treating Plant Showing Combination Measuring Tanks on the Right and Retort in the Background.

The pressure tanks are 8 ft. in diameter and 14 ft. high, made of 7/8 in. steel for a working pressure of 175 lbs. They are in reality a combination of pressure, measuring and drain tanks, and are located in such a way that they are readily filled while the treating cylinders are being filled preparatory to treating a charge of timber. Compressed air is then applied through the top of these pressure tanks and the preservative is forced through a pipe in the bottom connected with the cylinders. Pressure is maintained until the required absorption is obtained in the timber, after which the valve is closed and any preservative remaining in the tank can be returned to the working tank by means of the compressed air already in the pressure tank.

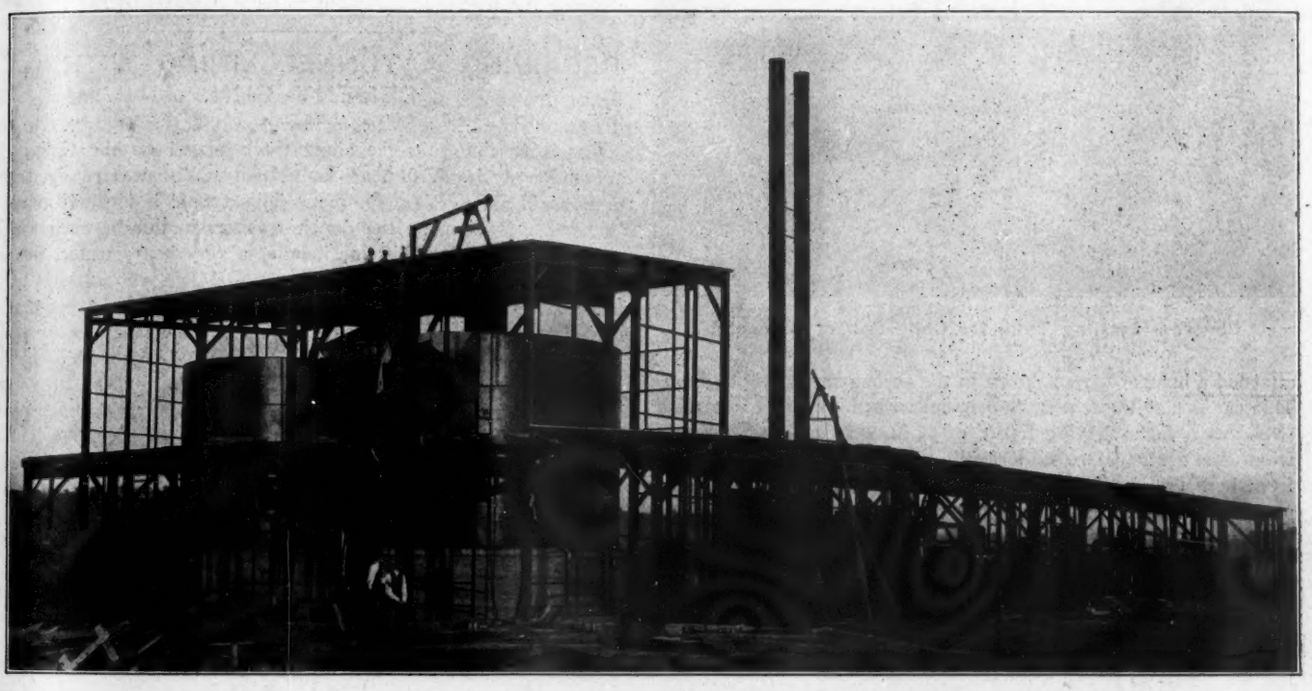
There is also a sufficient amount of compressed air in this tank to force all of the solution in the treating cylinder back to the working tank. The tanks are also used for measuring purposes, being equipped with mercury indicators which show the amount of solution, and thus inform the engineer as to the amount of solution going into the timber he is treating. They are also used as drain tanks to catch and measure the solution taken from the timber during the vacuum and draining process. The bottoms of the pressure tanks are only slightly lower than the treating cylinders, and though all of the drainings from the charge would not flow into the pressure tank by gravity, this is easily and quickly accomplished by admitting atmospheric pressure to the treating cylinder, while the pressure tank still contains a vacuum. This combination of pressure-measuring-drain tank is unique with the plant at Green Spring. It was worked out by the writer, assisted by Messrs. Card and McArdle, who were the draftsmen in getting out the pipe plans. This plant has now been in operation about two months, and these tanks have worked very successfully. It has been found that large oak ties can be treated to absolute penetration by the Card process in six hours, with an injection of from 14 to 16 lbs. of solution per cu. ft. It eliminates entirely the dirty and expensive pressure pumps commonly in use in timber treating plants.

Recording gages and recording thermometers are connected to the treating cylinders. This places the superintendent in complete touch with the treatment in all of its details, the charts indicating the temperature, pressure and vacuum recorded for every moment the plant is in operation.

The plant is heated throughout by steam, the vacuum system being used, all condensation being returned to the boiler feed heater and thence to the boilers. A 50 k. w. generator furnishes the light for the plant and the yard, there being three arc lamps and about 50 incandescent lamps in the system. The electric plant also furnishes current to operate two 10 h. p. centrifugal pumps and a one h. p. bilge pump. Eight inch centrifugal pumps are used to circulate the mixture of creosote and zinc-chloride in the retorts while using the Card process. The latter is placed in the settling tank and is used to pump creosote into the underground unloading tank.

An experimental plant is situated adjacent to the main building. This plant consists of a complete physical and chemical laboratory. The experimental cylinder is 30 in. in diameter and 9½ ft. long, or large enough to hold three or four ties. There are two working or pressure tanks, underground drain tank, pressure pumps and electric centrifugal pump. The tanks are equipped with the latest gages and thermometers, and the entire plant is so designed that any process can be used and pressure can be supplied as high as 300 lbs. The chemical laboratory adjoins the physical laboratory, and creosote distillations, zinc-chloride analyses, etc., will be made.

The office building is of concrete, and is fireproof in its entire construction, as are all the other buildings in the plant. The hose and engine houses are of wood, but these are small and located some distance from the other buildings. A fire system has been installed, and a fire department will be organized among the employees, which will be similar to that at large terminals, shops and other centers on the Baltimore & Ohio. A 6-in. water main has been laid the entire length of the tie yard and there is a hydrant every 300 ft. The hose house is near the office and is equipped with a reel of 300 ft. of hose. Water pressure for fire emergency is maintained by a high 50,000-gal. water tank kept filled at all times.



Main Building During Construction, Showing Cylinders and Inside Oil Tanks.

At the present time the water used in the timber treating plant is being pumped from the Potomac river, but this arrangement is but temporary until a permanent joint system can be built for the timber treating plant and for supplying water to locomotives in train service. The permanent water plant calls for two pumps located at the plant in a concrete well about 100 ft. below the surface of the ground. The depression was deemed necessary on account of the lift from the river. Water will be pumped into the high storage tanks and fed by gravity throughout the plant and yard.

Practically all of the ties treated at the plant to date have been oak, the number being approximately 200,000. The standard tie in use on the Baltimore & Ohio is 7 in. x 8 in., and 8½ ft. long, containing 3⅓ cu. ft. These ties are unloaded and cribbed in piles of seven and one, and are handled by piecework. It is the intention to air-season all ties. However, if they are not received in quantities sufficient to properly air-season, the plant is designed to give a preliminary steaming and vacuum before the injection of preservatives.

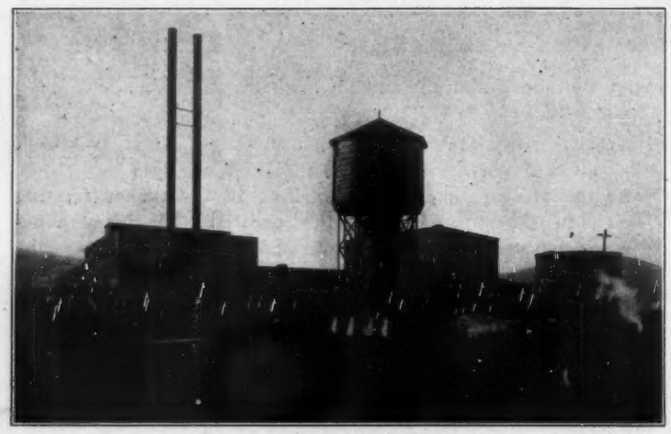
All storage yard tracks have three rails, the outside pair being

of standard gage and the inside rail fixing a 30 in. gage for the tram cars. In loading for treatment the ties are classified as hard and soft woods, and as No. 1 and No. 2. For this work the men are paid at a rate per tram instead of per tie, as in the case of unloading and cribbing for seasoning. Thus it makes no difference whether there are 30 or 40 ties on a tram, the cubical contents are practically the same and the amount paid is the same. One hundred and thirty tie cars are used to deliver the ties to and from the treating cylinders.

The cars are moved with a narrow gage locomotive, to which is

Concrete Settling Tank for Collection of Creosote.

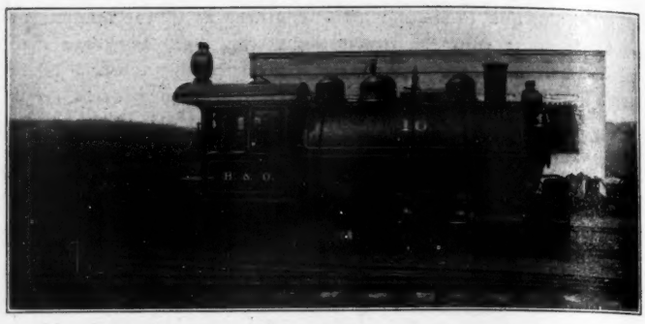
attached a bumper car as shown in the accompanying photograph. This car is also thought to be original with this plant. It carries two drums, each carrying 150 ft. of ⅝ in. wire cable. The cable from one drum passes underneath the engine out through the front bumper, and the other passes back through the back bumper. The engineer sitting in the cab can tighten the cable at any point along its length by means of cam and lever, and the switchman can pull out 10 ft., 50 ft. or 150 ft., as required. The cable is hooked to the links provided in the little tram cars, one



Power House, Sump, Retort Building and Storage Tanks.

of which can be seen in the little car just at one side and in front of the locomotive. An entire charge can be switched to any point in the yard by means of this arrangement.

The location of the timber treating plant is believed to be admirably suited for all purposes, being in near proximity to large timber areas. Green Spring is at the junction of the main line of the Baltimore & Ohio system, with the Romney branch, which extends 16 miles to Romney, W. Va., and the Hampshire Southern Railroad, extending 38 miles farther to Petersburg, tapping a timber tract of several thousand acres, much of it being virgin timber. The outlet for all timber adjacent to the lines men-

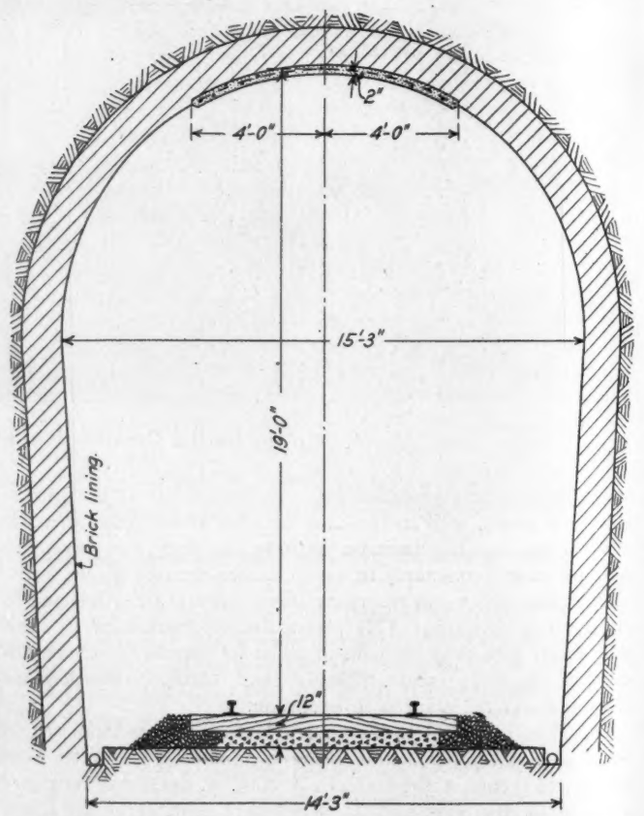


Narrow Gage Locomotive and Bumper Car.

tioned is by way of Green Spring, so it is merely a question of stopping the timber at the plant to have it seasoned and treated.

REPAIRING A TUNNEL LINING WITH A CEMENT GUN.

The brick lining in the single-track tunnel on the Chicago, Milwaukee & St. Paul, near Tunnel City, Wis., was repaired in an unusual manner last summer. This tunnel is located on the La Crosse division, on the double-track main line between Chicago and St. Paul. This line handles a very heavy traffic, there



Cross-Section of Chicago, Milwaukee & St. Paul Tunnel Showing Concrete Protection.

being an average of 32 train movements per day at this point during the period that the work was under way. The tunnel is located on the ruling grade and all tonnage freights are operated with pushers. The fact that both engines are worked to capacity has caused unusual wear of the lining by the locomotive blasts, and the doubling back of the pusher locomotives greatly

increases the number of movements. The old tunnel, which is 1,330 ft. long, was built in 1872, and was lined with brick, the arch having four rings. The mortar filling in the roof of the tunnel had been so damaged and the lower course of bricks so worn away as to make necessary some repair to the strip over the center line of the track to prevent the possibility of bricks falling out. The method adopted was to place a cement coat over a strip 8 ft. wide by the use of the cement gun, and the results secured have been very satisfactory.

It was the intention to place a coat of concrete which would extend 2 in. below the old face of the lining, making the total thickness from 4 to 6 in. in some places where the wear of the bricks had been most severe. The concrete never extended into the old lining for a distance greater than the thickness of one brick. Before placing the concrete, the surface was cleaned with a sand blast which was also handled by the cement gun, the water and cement, of course, being omitted for this process. The sand used both for cleaning and for the cement was the same as that used for ordinary concrete in that locality. It was dried and screened to remove pebbles and to prevent the clogging of the gun nozzle the water was also put through a wire gauze screen before going into the supply barrel. It was planned to use a ¼ in. square mesh wire reinforcement for the concrete coating, and some of this material was used at the beginning of the work. It was found, however, that this mesh was too small for the best results, and No. 4 American Steel & Wire triangular mesh reinforcement was substituted. This was cut to 8 ft. lengths and placed at right angles to the tunnel axis. From two to five coats of cement were required, depending on the thickness necessary.

In planning for this work it was thought that some form of shield would be necessary to protect the newly placed cement from locomotive blasts until it had thoroughly set. A movable shield to be supported from the roof was accordingly built and was used at the beginning of the work. It was soon found, however, that the cement placed by the gun was so hard immediately after placing that the locomotive blast had no effect upon it and the use of the shield was accordingly discontinued. Weep holes were drilled through the old brick lining near the edge of the concrete coating to allow water above the arch ring to escape and prevent its freezing there.

The air compressor plant was located at the east portal, a 2 in. air pipe being carried through the tunnel with connections at frequent intervals, to which rubber hose for operating the gun could be attached. The air was dried at the condensing plant to eliminate condensation in the pipe line. A water line was also carried through the tunnel to supply water at the gun nozzle. The plant at the portal also included a generator used for lighting the tunnel. Lighting wires were carried through the tunnel which could be tapped wherever necessary to provide illumination at the point where work was being carried on. Both the compressor and the generator were driven by gasolene engines.

The cement gun and the mixing board were carried on staging supported by two standard gage cars coupled together. A Fairbanks-Morse gasolene locomotive operating on a 2 ft. gage track having one rail in common with the main track was used to push this staging in and out of the tunnel. It was necessary to remove the entire outfit to a siding near the east portal for every train movement. For the protection of trains and also to enable the work of placing the cement to be carried on as long as possible between train movements, an operator was stationed at the east end of the tunnel and a flagman at the west end, both of whom were provided with telephones cut in on the despatcher's line. The despatcher notified the operator whenever a train entered an adjacent block and such train was held in that block until the track in the tunnel had been cleared.

The work was carried on for about two months, the progress being about 210 ft. a week. Two 10-hour shifts were used for six days in the week. The total cost, including labor and material, installation of the plant and preliminary cleaning was 23 cents per sq. ft. of protection placed.

This work was carried out under the general supervision of C. F. Loweth, chief engineer, Chicago, Milwaukee & St. Paul. L. D. Hadwen, engineer of masonry construction, was in charge of the plans for and execution of the work, and F. E. King, assistant engineer, directed the work at the tunnel.

A LOCAL SAFETY COMMITTEE.*

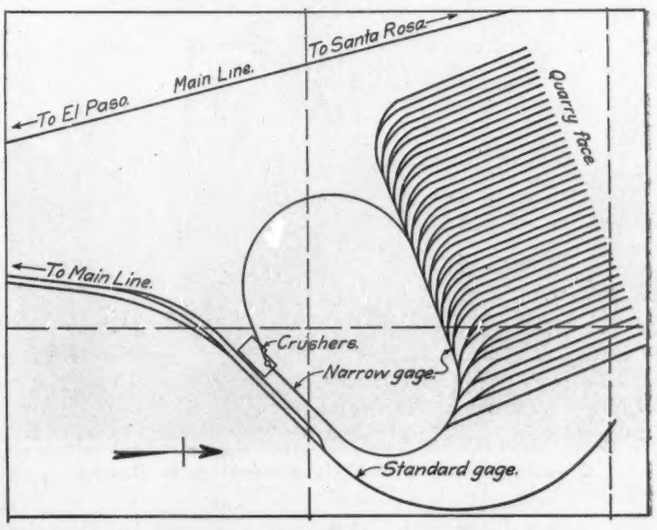
By F. Dohr,
Section Foreman, Chicago & North Western, Chicago.

About two years ago the roadmaster of the Chicago & North Western Chicago terminals appointed four of his section foremen as a safety committee in the terminal, arranging it so that none of the foremen went over his own section. The first time that these men went out on an inspection trip over the sections they were surprised at what they saw. They found safety blocking out of guard rails, switches and frogs, and found old rails, ties, draw bars, side doors and all kinds of old scrap lying around the tracks. There was also considerable old material piled so near the track that no one could walk alongside of the cars. This committee made a report to the roadmaster, who in turn reported to the central safety committee, sending a copy of his report to all his section foremen. At first some of the foremen did not like this, but the reports were continued each month and soon some sections were reported without criticism since when all the men have come into line and when the committee now goes over the territory a great improvement is noted and the yard looks 100 per cent. better than when the committee started its work.

*Received in the Safety contest which closed October 25, 1912.

BALLAST CRUSHING PLANT OF THE EL PASO & SOUTHWESTERN.

The El Paso & Southwestern operates a stone quarry for the preparation of ballast at Tecolote, N. M., on the Eastern division, 177 miles east of El Paso, which is of interest to railway men because of its arrangement and also for the highly creditable results secured. The crushing equipment consists of one No. 8, one No. 7½ and one No. 5 gyratory crushers. Stone is delivered to the crushers from the quarry by the system of



Track Layout at E. P. & S. W. Tecoloto Quarry.

tracks indicated on the accompanying plan. The primary quarry track is oval in shape, the front side of the oval passing over the top of the No. 8 and the No. 7½ crushers. The rear side of the oval lies parallel to the quarry face. This track begins to drop from the crushers on a 2½ per cent. grade which diminishes to a 1 per cent. grade on the rear side of the oval, this grade continu-

ing around to a point on the front side of the oval adjacent to the No. 8 crusher, at which point the track rises on an incline of 1 in 3, the difference in elevation from the bottom to the top of the incline being 20 ft. On the rear side of the oval, spur tracks lead off approximately at right angles to the face of the quarry, these tracks being on a level grade and extended as the quarry face recedes. The gauge of the tracks is 3 ft.

The quarry cars are all steel cars of 3 cu. yds. capacity, dumping from both sides directly into the hopper of the crusher. They

View Looking Towards Quarry Face.

run by gravity from the crusher, around the oval to the foot of the incline. On the rear side of the oval they are intercepted by the men loading the rock and switched out to the quarry face. After being loaded they are pushed back to the oval track and resume their gravity run to the foot of the incline, where they drop into a pocket, are automatically picked up by the chain hoist of the incline and also automatically released at the top.

The rock is loaded into the cars at the quarry face by contract at 25 cents per car, from 15 to 20 cu. yds. of ballast being loaded per nine hours per man actually engaged in loading. The quarry

Crushing Plant with Cars Ascending to Crusher.

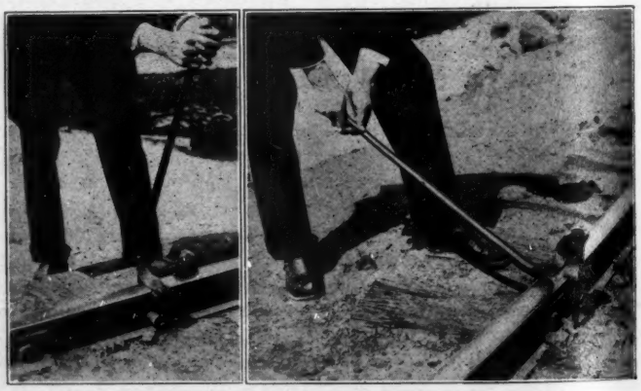
face is about 20 ft. high. Drilling is done with air, the holes being sunk to the floor of the quarry in one drilling. The rock is a very hard limestone, broken to ballast of a maximum size of 2 in. It is elevated from the crushers to bins and loaded by gravity from the latter into Rogers ballast cars, which are spotted on the track above the ballast bins and are dropped by gravity to and away from the bins as required, one switching per day only being required for this service.

During the working seasons of 1910, 1911 and 1912, comprising 365 days actual working time, 254,272 cu. yds. of ballast were produced, averaging 700 cu. yds. per day. During the first 105 working days in 1910, the average daily output was 900 cu. yds., during which time the average cost of ballast on board the cars at the crusher was $0.30314, the maximum for one month being $0.34612 and the minimum $0.24363 per cu. yd. During this time the total cost of finished ballast in the track was $0.56522, the maximum for one month being $0.61072 and the minimum $0.48214. This was with a short haul of 40.3 miles and the common labor at $1.25 per day. During the seasons of 1911 and 1912, common labor advanced to $1.50 per day and the average total haul for all time to 94.3 miles. The average cost per cu. yd. of ballast on board the cars at the crusher for the entire work was $0.40541, and the average total cost of completed ballast in the track was $0.74352. All figures herein include total cost of maintenance and operation in producing ballast and finishing it in the track, but they do not include cost of inserting new ties and gaging track. The detailed cost data for finishing the entire 254,272 cu. yds. of ballast in the track, averaging 2,500 cu yds. per mile of single track, are as follows:

	Total cost.	Cost per cu. yd.
Superintendence	$4,441.20	$0.01747
Drilling and blasting	5,934.68	0.02334
Powder	18,143.10	0.07135
Loading in quarry	34,308.12	0.13492
Haul to crusher	10,587.66	0.04164
Crushing	18,190.55	0.07154
Tools and supplies	11,490.57	0.04515
Opening track	11,244.24	0.04422
Haul to track	34,846.45	0.13704
Unloading	1,542.48	0.00606
Raising track	16,964.05	0.06672
Lining, surfacing and dressing	21,365.10	0.08402
Total cost	$189,058.20	
Cost per cu. yd	$0.74352	
Cubic yards	254,272.00	
Average haul in miles	94.30	

A NEW SPIKE PULLER.

The spike puller illustrated in the accompanying cuts has been invented by J. E. Jones, Carneyville, Wyo., and is being used on one of the western divisions of the Chicago, Burlington & Quincy. The principal advantage of this puller over a claw bar is that it will pull a spike straight up, eliminating the friction caused by the bending of the spike and leaving the old



Spike Puller for Track Spikes.

spikes in condition to be redriven. A straight pull also causes less damage to the tie than is the case when the spike is pulled to one side, greatly enlarging the old hole. The device is easily attached to the spike and has a very short lever arm from the support on the head of the rail to the grip on the tie, allowing the spike to be pulled without exerting an excessive effort at the end of the bar. The length of the bar is about 30 in. The device complete weighs about 10¼ lb. On account of the fact that leverage is secured on the head of the rail, this device can be used to pull spikes between main rails and guard rails at frogs or crossings as easily as in other locations.

RENEWING TWO SWING SPANS UNDER TRAFFIC.

Use of Open Timber Caissons in Building Concrete Piers for Grand Trunk Bridges at Lacolle, Que., and Portland, Me.

During the year 1912 the Grand Trunk renewed two single track swing bridges, one at Lacolle, Que., over the Richelieu river which is the northern outlet of Lake Champlain and the other at Portland, Me., over Back Cove bay, both renewals being undertaken in order to strengthen the bridges to accommodate the heavier motive power now in use. Coopers E 50 loading was used in the design.

RICHELIEU RIVER BRIDGE.

The Richelieu river bridge originally consisted of a swing span 180 ft. long, with two clear channels of 73 ft. each, with a pile

Fig. 1—Motor Boat Towing a Barge of Rock for Riprap.

trestle approach 500 ft. long on the west end and one 350 ft. long on the east end. The center and rest piers under the swing span consisted of timber cribs filled with rubble stone surrounding the supporting piles which were capped with timber grillages on which were carried concrete tops. The center pier was 26 ft. square and 33 ft. high. In renewing this pier a double wall caisson 38 ft. square over all, built up of 10 in. by 10 in. horizontal wall timbers and 12 in. by 12 in. vertical timbers, was sunk around the old pier, leaving a space between it and the old crib of 3 ft. 2 in. This caisson rested on a heavy shoe, the outside edge of which was vertical and the inside beveled at an angle of 45 deg. The shoe was made up of a longitudinal 10 in. by 14 in. oak timber beveled to form a cutting edge, and upon it two transverse sections of 12 in. by 12 in. timbers also beveled and all drift bolted together.

The caisson of the center pier and all the double wall caissons, were sunk by filling the 12 in. space between the walls with concrete. If one or more points reached a firm bearing with the caisson level before other points touched the bottom, an even bearing was secured by filling in bags of concrete placed by a diver. After the bottoms were sealed with this concrete, loose concrete was placed between the caisson and the old crib by means of a bottom dump bucket.

When the 3 ft. 2 in. wall of the center pier was filled up to approximately 3 ft. below low water level, reinforced concrete walls were carried up on this wall to the top of the old pier to support the 11 by 26 in. 166 lb. special I beams on which the swing span was carried during the completion of the pier. The reinforcement consisted of ¾ in. and 1 in. twisted rods placed as shown in the accompanying cut.

It was originally intended to complete the center pier by cleaning out all the rubble stone filling in the old crib one pocket at a time, but this was found to be impracticable owing to the slaty character of the rock foundation which made unwatering almost impossible. Instead of unwatering the pier, water was pumped into it creating a head of about 3 ft., which was utilized in forcing a 1:2 mortar through the voids in the rubble stone. This process was continued until all the voids were filled when the regular concrete was used. The mortar was deposited on the rubble by tremie. This method gave excellent results, as the concrete with the rubble stone as an aggregate resulted in a 1:3:5 proportion. The old concrete pier top was allowed to remain with the exception of the upper 18 in., which was broken up by blasting. The 108 cedar piles which supported the old pier top were also left in place, thus adding somewhat to the supporting power. The completed pier contained 1,620 yds. of concrete.

The new swing span is 250 ft. long providing two clear channels of 97 ft. each. It was erected on falsework driven under the old span. Construction work started January 1, 1912, and the new swing, the two rest piers and the outside portion of the center pier were completed March 20, 1912, in time for the opening of navigation. This work was handled during a very severe winter, some of the concrete being placed at temperatures as low as 20 deg. below zero. The center pier was protected during construction by steam pipes connected with a 30 h. p. boiler located on the old protection work. This boiler also supplied steam for the pumps.

All the protection piles and cribs of the old bridge had to be replaced, the new work consisting of six cribs built of 10 in. by 10 in. timbers loaded with rubble stone. These cribs are joined to each other and to the rest piers by floating booms. The booms consist of 12 in. by 12 in. timbers spaced 1½ in. apart by blocks, and bolted with 1⅛ in. bolts at intervals of 3 ft. These booms average 30 ft. long and are held in position by two 12 in. by 12 in. vertical timbers bolted to the cribs and rest piers.

The old center protection work below low water was allowed

Fig. 2—Framing Timber Caissons for Richelieu River Bridge.

to remain and after strengthening it by the addition of five new cribs, a continuous new top with a double row of walings was built. The center pier and protection work was built in 30 ft. of water.

The approaches to the new swing span consist of seven spans of 60 ft. each on the west and five spans of 60 ft. each on the east end. Deck plate girders resting on concrete piers have been used for these approaches. The three shore piers on the west end and the two shore piers on the east end were built with single wall caissons, the other seven piers being built with

double wall caissons similar to that used for the center pier. These double wall open caissons rest on a heavy shoe as described above. The 10 in. by 10 in. wall timbers were well caulked and pumping was started generally after about two-thirds of the concrete required below the elevation of low water was placed. The intermediate piers are practically 50 ft. long and 16 ft. wide. Both the upstream and downstream ends are pointed, the angles being 45 deg. and 30 deg. respectively.

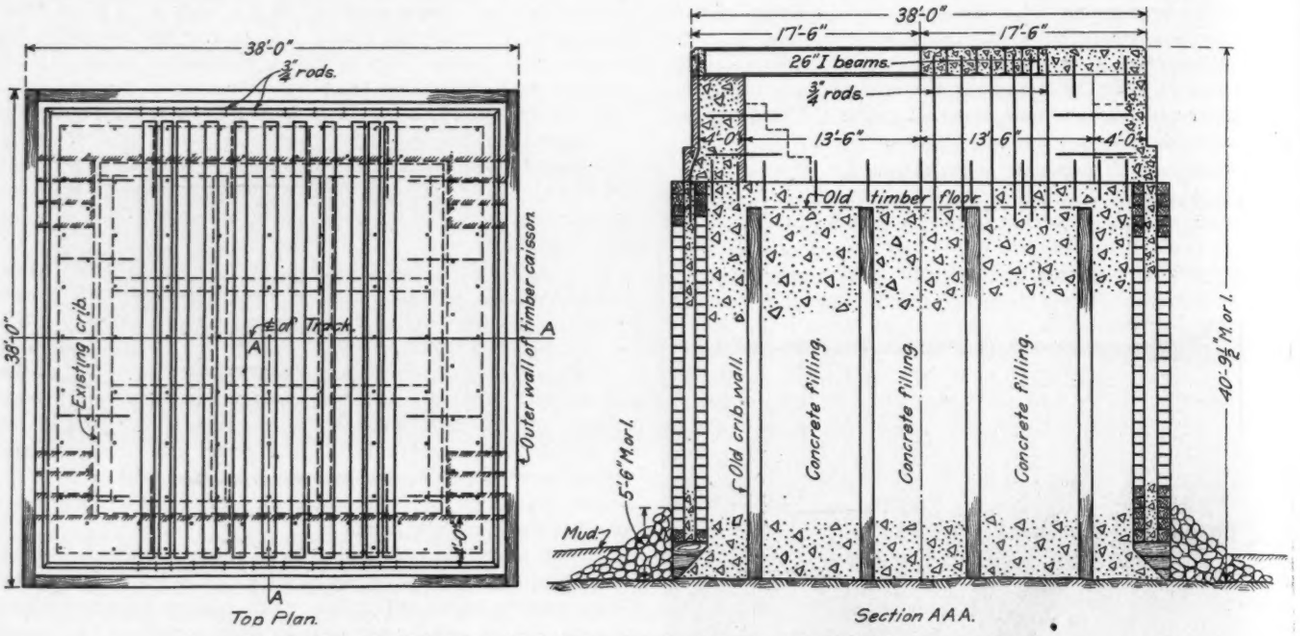


Fig. 3—Plan and Section of Caisson for Center Pier of Richelieu River Bridge.

The pier noses are protected by one-half in. plates. All the piers rest on the natural bottom of hard pan and slate rock, except two piers and one abutment, on the east end, where it was found necessary to drive piling. The foundations on natural bottom were well cleaned of the loose top material by a diver.

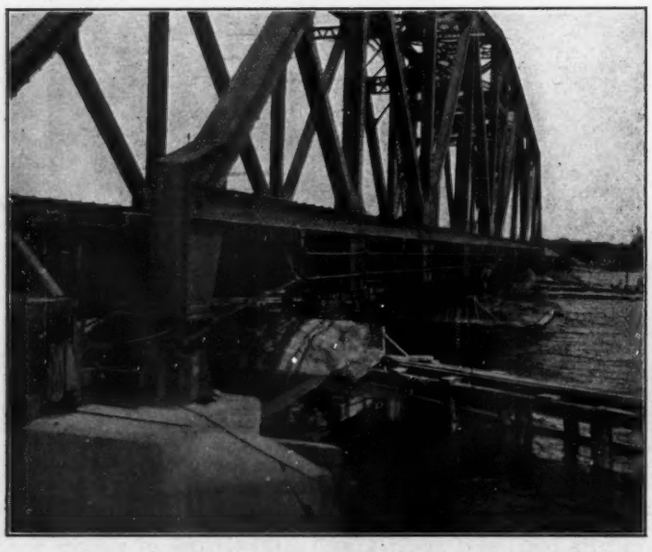


Fig. 4—New Span in Place on Completed Rest Piers, Showing Construction of Center Pier and Protection Work.

Blasting was resorted to very frequently in removing large boulders that were in the path of the cutting edges of the caissons. All the old protection work, rest piers, and piles of the old trestle approaches were removed by blasting and generally the dynamite was placed by the diver. Rip-rapping was done quite extensively and as much as 5 ft. of rubble stone was placed around the lower edge of the caissons.

The concrete plant was located on the west bank between the main line and a standard gage material siding. All sand and stone was unloaded directly from this siding at a convenient distance from the mixer, the storage piles being covered. A one-half yd. cube mixer with side loader was used, steam being furnished by a 45 h.p. horizontal boiler. Exhaust steam from this plant was turned directly through the sand and stone and served to keep these materials sufficiently warm during the severe winter. A hoist alongside the mixer handled the buckets into which the concrete was dumped, placing them on narrow gage cars which were operated on a track from the mixer out across a temporary trestle alongside the bridge for its full length. While the river was open a 30 ft. motor boat with an 18 h.p. engine capable of making 15 miles per hour was used to very good advantage in towing barges and handling material to and from the bridge site.

Fig. 5—New Swing Span and Approaches at Lacolle, Que.

The twelve deck plate girders weighing 28 tons each were erected in 5½ days. The old pile bents were cut off below low steel, and the old bridge floor removed by a derrick. As the grade line was raised 3½ ft., temporary timber approaches were used at both ends.

BACK COVE BAY BRIDGE AT PORTLAND.

The work at Portland consisted of renewing a single track

bridge 225 ft. long, replacing the two rest piers and retopping the center pier. The grade line was raised 3 ft. at this bridge, requiring a new top on the old masonry center pier which proved to be in very good condition after 20 years of service. The same design of open caisson was used as that described above for the Richelieu river bridge. In this case the caissons were sunk through blue clay. One was driven to rock 42 ft. below high tide and the other to the same elevation being supported on piles driven inside the caisson as the rock at this point was 75 ft. below the old base of rail or 67 ft. below high tide. The concrete was deposited by bottom dump buckets under water and by tremie, special cars being taken to secure the best quality of work in order to withstand the action of sea water.

The piers were of concrete faced with granite masonry, thus insuring permanent results, as investigations showed that concrete suffered from frost owing to the variations in tide level. The difference between average low tide and average high tide at this point is 10 ft.

The J. S. Metcalf Co. Ltd., were the contractors for both bridges. The Dominion Steel Co fabricated and erected the Richelieu river bridge and the Pennsylvania Steel Co. had the contract for the Back Cove bridge. The work was handled under the supervision of H. R. Safford, chief engineer, and R. Armour, masonry engineer, Albert Larsen being the resident engineer in direct charge of the work.

EFFICIENCY IN BRIDGE WORK.

By L. C. Lawton,

Division Engineer, Atchison, Topeka & Santa Fe, Newton, Kan.

It is not a paradox that some of our most successful superintendents or general foremen of bridges are making their individual gangs all-round workmen and specialists too. It is necessary that every regular bridge gang should be able to man a pile-driver, crib a bridge or build any kind of false work. One gang may do all the difficult driving, but if the gangs are assigned to certain districts, each one should be able to, and should have the opportunity to drive the bridges or false work on that division. It frequently happens that the best gang is caught away from the pile-driver during a washout and that is no time to break in a green gang and foreman, nor even for an experienced foreman to take men who are not trained. No doubt this has been impressed on many officials in the flood districts recently, especially where their permanent work has called for little use of a pile driver. In such cases the pile driver drill should be a part of their work, as the fire drill is of most shopmen.

Not only should each man be taught his place on the driver, but should be able to make a driver in short order from a hoisting engine and with swinging, or in a pinch, with no leads at all. In this way an old drop hammer would be all the extra equipment needed to carry on this work. We had an experience of this kind during the last year, when an old drop hammer was swung from the boom of a derrick car, and swinging leads made in a few hours, enabling us to drive false work for a steel bridge on a distant branch line when the regular driver was in the shop for repairs and no other could be secured. By so doing, we avoided tying up a very expensive steel gang.

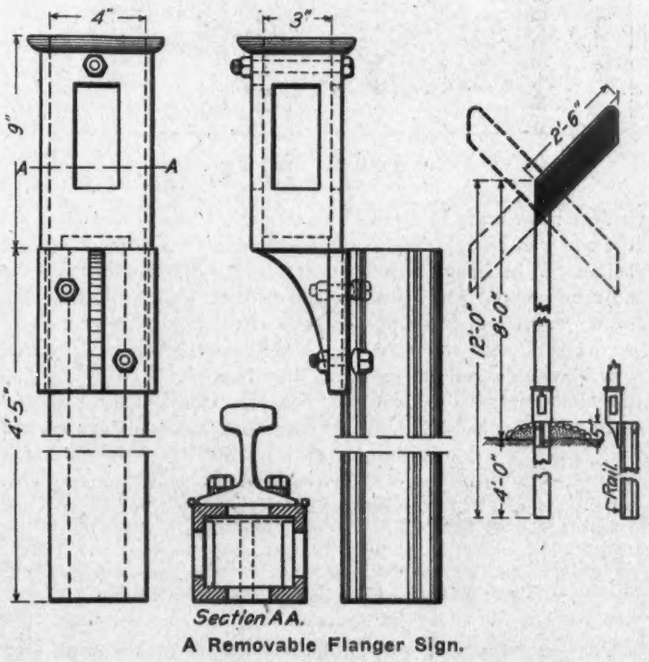
A part, at least, of each gang should also be familiar with cribbing. Every engineer knows how exasperating it is to get a gang of inexperienced men in water 4 to 6 ft. deep and with more or less current and start a crib. The chances are that they will build up without a foundation, or if one is started properly it will wash out or topple over when half completed. Few old time bridge men are left, and those of the present day are often only second rate carpenters and helpers, as the better men can get higher wages and an easier life in other work.

With reference to creating an efficient organization, I would not advocate an apprenticeship, but would suggest that all gangs have some drill in caring for bridges or track in case of flood, fire or other disaster. On the other hand each extra gang, and there should be several, should be specialists in their line. One or more, if needed, should do the building, and in this can be placed the best house carpenters that can be picked up. This will make a gang entirely unlike any other on the road and should be so. Another will be the concrete gang and, in a large part, composed of concrete laborers. Added to this will be one or more form carpenters, although it is often an advantage to use these men on light repair work in buildings when form building is not under way. After a little training, this gang can be used on rough false work at but little over the average wage for concrete work. This has been found much cheaper than contracting this class of work, as in any case, the company is responsible for the false work and usually keeps a bridge gang either on the work, or accessible to it. The concrete is often placed by our men in the time that was lost by the old method and the contract price saved. During the last few years much of the cut masonry placed when our road was built has shown signs of decay and is being replaced by monolithic concrete. The cost of false work varies in each job, but cost of labor in removing the old masonry runs from $1.50 to $2 per yd. on forms fifty to sixty cents, and of placing concrete $1.75 to $2 per cu. yd. The cost of embankment or foundation excavation varies greatly, running from $0.40 to $1.25 per yd.

Light repair work on both bridges and buildings is carried on by a small floating gang, either made up on a large district, by two or three men detached from the regular gang, or by a few men who accompany the bridge inspector and who go over the entire division in a month or six weeks. By having these light jobs, which need immediate attention, taken care of, the gang foreman can so plan his work as to move from one station to the next, or at least in the same direction all the time and avoid the expensive moving back and forth.

A REMOVABLE FLANGER SIGN.

The standard flanger sign of the New York Central & Hudson River is made in two pieces, the base being set in the ground permanently, and the upper, or sign, portion being removed during the summer when there is no occasion for its use along the track. The lower portion or base extends about 4 ft. below the ground, with a socket 9 in. long extending above

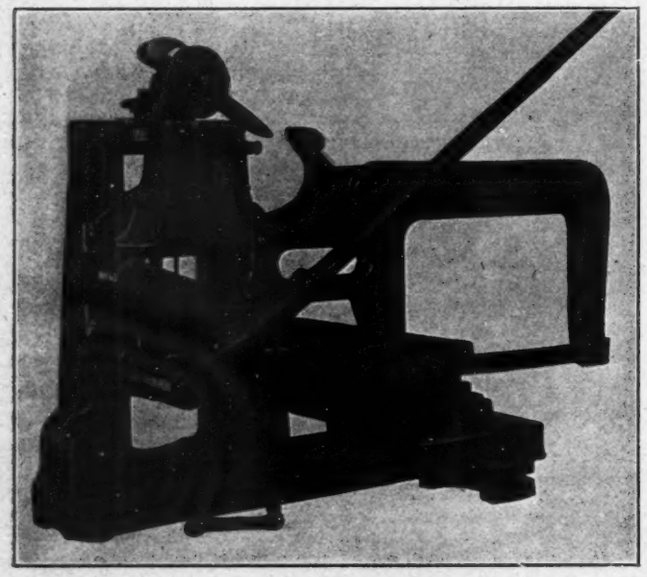


A Removable Flanger Sign.

ground into which the post of the sign is inserted, the latter being held in place by one bolt. When serving solely as a flanger sign, only one wing is put on, as shown solid on the drawing. Where the sign serves also as a snow plow wing sign, the upper arm on the left is added as shown in heavy dotted lines. At points where the flanger has to be raised and the wings of the snow plow closed in at the same time, a cross is used as indicated in light dotted lines. We are indebted to C. E. Lindsay, division engineer, for this information.

THE FLESTER RAIL SAW.

With the rapidly increasing use of open hearth rails the difficulty in cutting rails quickly and accurately has been greatly increased. To meet the demand for a saw to perform this work the Flester rail saw has been devised, an important feature of which is its positive automatic feed. This automatic feed is secured by means of a ratchet, the cam of which is moved at each stroke of the handle. The rate of speed is adjustable by a slide arrangement on the cam so that it can be changed as desired. In actual performance the lowest feed is used in cutting through the top of the rail, a much higher feed through the web, and a medium feed through the base. The saw is rigidly built so that



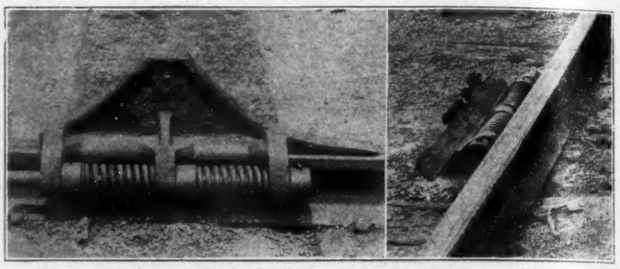
The Flester Rail Saw.

it does not vibrate in service and cuts clean. By removing a pin the saw can be adjusted to cut at any angle. By removing one bolt it can be tipped back to clear trains without disturbing the adjustment, and when thrown back in position it will strike the same cut without breaking the teeth of the blade. A ring is inserted in the top of the saw over the center of gravity through which a handle can be placed enabling two men to carry it. The machine weighs 120 lbs. A test on the New York Central showed that this machine would cut through their standard high carbon rail in 12.5 min., while girder rails on the Interborough Rapid Transit Lines in New York have been cut in 14.5 min. This saw is sold by Flint & Chester, 237 Lafayette street, New York City.

THE RINK HINGED RAIL STOP.

The accompanying photographs show a hinged rail stop which is designed especially for use on car floats, docks and terminal tracks and on tracks leading to car floats and transfer tables. This device is not intended to stop cars running at high speeds, but rather to prevent cars from starting because of impact shocks or wind. When in use, it is thrown up on the rail as shown, and if a through track is desired, the stop is easily thrown on its side.

The stop consists of three parts, a lower casting or bracket which is secured to the web of the rail by four bolts, the top casting which normally rests upon the head of the rail when in service, and a coil spring. The top casting is provided with a wedge protection and the face of the stop toward the wheel is also curved upward to offer resistance to a wheel climbing up on the stop. This casting is also provided with flanges projecting over both sides of the head of the rail to hold it in position. The coil spring opposes the longitudinal movement of the top



Rink Hinged Rail Stop in Service and Out of Service.

casting along the rail and serves to absorb the momentum and shock imparted to the device by a moving wheel. The friction between the stop and the rail is greatly increased by the weight of the wheel on the stop, and also materially assists in retarding the movement. One of these devices is placed on each rail when in use. This stop has been in service in tracks leading to the transfer table in shop yards of the Central R. R. of New Jersey at Elizabethport, N. J., for some time, and is also in use on tracks of the Lake Shore & Michigan Southern at Collinwood, Ohio. It was devised and patented by Geo. W. Rink, mechanical engineer, Central Railroad of New Jersey, Jersey City, N. J.

A PENNSYLVANIA WORK CAR.

By C. H. Thomas.

The accompanying photograph shows an old style passenger coach which the Pennsylvania has remodeled and is now using in the maintenance of way department. This car is fitted up at

A Pennsylvania Work Car.

the rear end with an office for the work train conductor. Back of this there are two rooms with seats on either side for the use of track hands and other laborers. A commissary is also located in this car.

General News.

The anti-noise campaign in Chicago is receiving the co-operation of the railways, several of which have promised their assistance by eliminating some of the whistling of locomotives and ringing of bells which the city council committee deems unnecessary.

The twenty-first annual meeting of the Society for the Promotion of Engineering Education will be held at Minneapolis June 24, 25 and 26. Among the papers to be presented will be one on the "Revision and Standardization of English Technical Terms."

An elevated railroad is being built in California at the Oakland terminal of the Southern Pacific—the only elevated railroad west of Chicago. The elevated line will be a double track structure with ballasted floor, 12 blocks (3,844 ft.) long, and will accommodate the suburban electric passenger trains.

The "Diamond Special" Express of the Illinois Central, northbound, was stopped by robbers about 13 miles south of Springfield, Ill., on the night of June 17, and the engineman was compelled to pull the express car some distance away from the passenger cars where a stop was made and the express messenger was overpowered and the safe blown open.

Special despatches from Washington say that the bill, or one of the bills, for the construction by the government of a railroad in Alaska, is to be urged for early passage in Congress, and that President Wilson has in a general way approved the project. The bill in its present shape will put the control of this enterprise in the hands of the president, the committee having cut out the provision for a special commission. The amount of bonds authorized to be issued, as now stated in the bill, is $40,000,000.

The bill to amend the Erdman Act, providing for conciliation and arbitration in controversies between interstate railroads and their employees, which was reported in the *Railway Age Gazette* last week, page 1328, is understood to have the approval of all important interests, the railroads, the officers of the railroad brotherhoods and the National Civic Federation; and a committee representing these different interests expects to have conferences with congressional committees at Washington this week, looking to early action.

"How to Repair and Maintain the Roads" is the title of a bulletin which has been issued by the Office of Public Roads of the Department of Agriculture. It does not treat the subject of road building, but takes up the repair and care of roads after they are built. All classes of roads, from the natural earth road to the macadam roads with bituminous surfacing, have received attention. The action of automobiles on road surfaces is explained. The systems of road management in Massachusetts, New York, England and France are given, with tables of costs.

The Public Service Commission of New York, for the First District, has written a letter to Governor Sulzer, asking him to urge upon the special session of the Legislature, convened this week, to make an appropriation of $1,278,025 as the State's one-quarter of the estimated cost of eliminating grade crossings on the Atlantic Avenue Division of the Long Island Railroad, between the end of the present elevated structure and the westerly end of the Jamaica improvement. The commission sets forth the number of accidents which have occurred since the commission was organized, July 1, 1907. These include 15 fatalities and a large number of serious injuries. The conditions at the most dangerous of the crossings are set forth in detail.

Railway Terminal Discussion in Chicago.

New plans for the solution of the terminal problem in Chicago continue to be presented to the committee on terminals of the city council. The latest is that of William Drummond of the architectural firm of Guenzel & Drummond, who suggests a main trunk line at Englewood to be used by all through traffic entering from the south, and a three-sided loop with connections to handle the traffic from the west and north.

Following the Pennsylvania's ultimatum last week, to the effect that unless the road's plan for a west-side terminal is approved the present inadequate facilities will be continued indefinitely, the council committee has held several meetings at which the various plans were discussed by interested parties. Architect A. J. Graham presented arguments for the Pennsylvania plan, and F. O. Butler of the J. W. Butler Paper Company—whose opinion is probably representative of that of the business men in localities embraced in the various plans—supported Mr. Graham's contentions.

On Saturday of last week Jarvis Hunt, sponsor of one of the plans, gave the committee of councilmen a long address, the burden of which is well expressed by the word "ouch." He accused Joseph Wood, one of the vice-presidents of the Pennsylvania, of saying that "he didn't give a cuss about Chicago," and later of reiterating his statement to the effect that he "cared nothing about Chicago." Mr. Hunt also accused Darius Miller, president of the Burlington, of changing front on the subject without sufficient reason. He referred to a book written by President Rea of the Pennsylvania, called "The Railways Terminating in London," in which he said the segregation of traffic was urged; disclaimed all but altruistic motives in spending his own time and money in the preparation of his terminal plan; and expressed himself otherwise in a manner which tended to show that he was considerably aggrieved because the railroads involved have not seen fit to discard the results of seven years of planning on their part and accept his proposition.

The Chicago Association of Commerce, on June 11, addressed an open letter to the mayor, the city council and the citizens of Chicago urging delay in passing the proposed smoke abatement and electrification ordinance which would demand electrification of all railroad terminals by June, 1915, and which has received the recommendation of the council committee on terminals. The association denies vigorously the accusation that it has attempted to thwart electrification or smoke abatement in the city, and says that its report, which has been in course of preparation for three years, will be ready in 1914, and will come nearer the desired solution of the problem than any haphazard action which may be taken by the council without a comprehensive investigation.

At one of last week's meetings of the Council Committee, Robert C. Sattley, valuation engineer for the Rock Island Lines, presented a scheme for a union station to include all the railways entering the city, even the Illinois Central, and to be located west of the river at a distance from the loop district not much greater than the new North Western terminal. Mr. Sattley's plan is the one that was originally presented in 1901 before the Western Society of Engineers and published in proceedings of that organization, but with revisions to bring it up to date.

Engineers Wanted for Valuation Work.

The United States Civil Service Commission, Washington, has issued its announcements of examinations to be held for filling positions in the Interstate Commerce Commission under the act providing for the valuation of the property of railroads. The examinations will be held July 23, at the usual places in different parts of the country, and the places to be filled are as follows:

Senior structural draftsman	Salary	$1,800 to	$4,000
Senior mechanical engineer		1,800 to	4,800
Senior railway signal engineer		1,800 to	4,800
Senior electrical engineer		1,800 to	4,800
Senior inspector of car equipment		1,800 to	3,600
Senior civil engineer		1,800 to	4,800
Senior inspector of motive power		1,800 to	3,600
Senior architect		1,800 to	4,800
Architect		1,080 to	1,500
Inspector of motive power		1,200 to	1,500
Civil engineer		720 to	1,500
Inspector of car equipment		1,200 to	1,500
Electrical engineer		1,080 to	1,500
Railway signal engineer		1,080 to	1,500
Mechanical engineer		1,080 to	1,500
Structural engineer		1,080 to	1,500

In the case of positions for which the salaries are $1,800 or more the applicants are not required to assemble at any place for examination, but are rated according to the documentary evidence presented.

Persons desiring to enter an examination should at once apply for blank form 2039 to the United States Civil Service Commission at Washington, D. C.; or to the secretary of the Board of Examiners, at Boston, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, Seattle, San Francisco, New York, New Orleans, Honolulu, St. Louis, or to the chairman of the Porto Rican Civil Service Commission, San Juan.

Disastrous Fire at Oak Island, N. J.

In the burning of a trestle bridge of the Lehigh Valley across Newark Bay between Waverly and Greenville, N. J., on Sunday morning last, about 3,000 ft. of the bridge, together with the same length of the bridge of the Pennsylvania Railroad adjacent, were destroyed above the waterline, and the lines of both these roads to their freight termini at Communipaw and Greenville were put out of business for perhaps two weeks. The loss, including cars, is estimated variously at from $500,000 to $1,000,000. The fire is said to have started from sparks thrown by a locomotive, without a train, running at high speed. The floor of the trestle was of new creosoted ties and burned rapidly; and it is said that drippings of oil had made the floors of both bridges highly combustible. Both of these bridges are double track. Thirty cars of freight were either burned or fell into the bay, a freight train having been held on the trestle because of a blockade on the track ahead of it. Firemen from the nearby cities were obliged to pump water more than a mile to reach the fire, and fireboats in the channel were kept a long distance from the fire because of the low tide.

New Railroad Law in Massachusetts.

The legislature of Massachusetts has passed a law empowering the New York, New Haven & Hartford to own, operate and extend electric railways in the western part of the state—the law covering, it is said, all of the city and interurban lines west of Worcester. This law was adopted on June 12 by very large majorities in both houses after it had been vetoed by the governor. On June 12 also the governor vetoed the bill to enlarge the number of men in the Railroad Commission, to change the title of the commission, and to give it many new powers; and this law also was soon adopted over the governor's veto.

Under the new law, which is called the Washburn law, the railroad commission becomes the Public Service Commission and will have five members instead of three. It gives extensive power of regulation of railways, similar to those of the public service law of New York, and the board will have the same authority to enforce its orders reducing rates, etc. There is the usual elaborate prohibition of free passes and free service. The commission is specifically authorized to order changes in the number of men in train crews. Two sections concerning which there was much controversy and the terms of which were given by the governor as the chief reasons for his veto, sections 15 and 16, authorize railways to incur indebtedness equal to twice the amount of their capital stock, but every act of a corporation in financial matters is under the close supervision of the commission.

The Wicked Express Companies.

We are constantly hearing complaints about the high cost of living. The pessimist, who is always with us, cries out that we are taxed from the cradle to the grave; but the worst, it seems, is yet to come. The Pennsylvania State Anatomical Board, which has charge of the pleasant task of the distribution of the bodies of the unclaimed dead to medical schools, has complained to the Railroad Commission that the express companies are about to double the rates for carrying this class of freight. The only explanation of it is that the express companies, being no longer able to practice extortion on the living, propose to take it out on the dead.—*Philadelphia Inquirer.*

Tool Foremen's Convention.

The American Railway Tool Foremen's Association will hold its fourth annual convention at the Sherman Hotel, Chicago, July 22, 23 and 24. All foremen in charge of the tool department of steam and electric railway shops are eligible to membership, and all railway foremen are invited to the convention whether members or not. There will be elaborate exhibits of tools and machinery in the exhibition hall adjoining the convention room, in charge of A. H. Ackerman.

It is expected that there will be a number of higher railway officers present as speakers, and the program is as follows:

1. Reclaiming of Scrap Tool Steel; J. J. Sheehan, chairman. 2. Making of Thread Cutting Dies; A. W. Meitz, chairman. 3. Making of Forging Machine Dies; B. Hendrickson, chairman. 4. The Electric Furnace for Tempering Tool Steel; Method of Operation, Cost of Maintenance, and Results Obtained; C. A. Schaffer, chairman. 5. Superheated Tools and Their Care; H. Otto, chairman. 6. The Form of Thread and Degree of Taper for Boiler Studs and Boiler Plugs; A. M. Roberts, chairman.

American Society for Testing Materials.

This association, affiliated with the International Association for Testing Materials, will hold its sixteenth annual meeting at Atlantic City, N. J., next week, Tuesday, Wednesday, Thursday, Friday and Saturday, at the Hotel Traymore. There will be business meetings morning and afternoon, and on Tuesday and Wednesday evenings. Following are the principal subjects on which reports and papers will be presented: Standard Specifications for Coal; Standard Specifications for Rubber Products; Preservative Coatings for Structural Materials; Standard Tests for Lubricants; Tests on the Rate of Corrosion of Metals; On Heat Treatment of Iron and Steel; Heat Treatment of Hypo-Eutectoid Carbon-Steel Castings; Tests Made on Rail-Steel Concrete Reinforcement Bars; Standard Specifications for Steel; Rail Failures and Their Causes; Resistance of Steels to Wear in Relation to Their Hardness and Tensile Properties; Effect of Small Percentages of Vanadium on the Physical Properties of Steels; Standard Specifications for Wrought Iron; Standard Specifications for Cold-Drawn Steel; Tests of Welded Boiler Tubes; Mechanical Tests of Heat-Treated Spring Steel; Oxygen in Iron and Steel; Value of Ledebur Method in its Determination; Standard Specifications for Cement; Reinforced Concrete; Method and Apparatus for Determining Consistency of Concretes; Autoclave Tests for Cement; Waterproofing Materials; Tests of Reinforced Concrete Slabs Under Concentrated Loading; Test Data on an Experimental Concrete Bridge; Ceramics and Road Materials (seven reports); Standard Specifications for Copper Wire; Metallographic Study of Lead-Tin-Antimony Alloys; A Study of Bearing Metals and Methods of Testing; Conservation and Shipping Containers; Efficiency and Safety in Explosives Used in Blasting; Large Capacity Testing Machines in this Country and Europe.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.

American Association of Demurrage Officers.—A. G. Thomason, Boston, Mass. Convention, May 19, 1914, St. Louis.

American Association of General Passenger and Ticket Agents.—W. C. Hope, New York. Annual meeting, October 14-15, Philadelphia, Pa.

American Association of Freight Agents.—R. O. Wells, East St. Louis, Ill. Annual meeting, June 17-20, Buffalo, N. Y.

American Association of Railroad Superintendents.—E. H. Harman, St. Louis, Mo.; 3d Friday of March and September.

American Electric Railway Association.—H. C. Donecker, 29 W. 39th St., New York.

American Electric Railway Manufacturers' Assoc.—H. G. McConnaughy, 165 Broadway, New York. Meetings with Am. Elec. Ry. Assoc.

American Railway Association.—W. F. Allen, 75 Church St., New York. Next meeting, November 19, 1913, Chicago.

American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago. Convention, October 21-24, 1913, Montreal.

American Railway Engineering Association.—E. H. Fritch, 900 S. Michigan Ave., Chicago.

American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony building, Chicago.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.; annual, June, 1913.

American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.

American Society of Engineering Contractors.—J. R. Wenlinger, 11 Broadway, New York; 2d Tuesday of each month, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York.

American Wood Preservers' Association.—F. J. Angier, B. & O., Baltimore, Md. Next convention, January 20-22, 1914, New Orleans, La.

Association of American Railway Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago. Annual meeting, May 28, Atlantic City, N. J.

Association of Railway Claim Agents.—J. R. McSherry, C. & E. I., Chicago.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago. Annual convention, October 18-24, Chicago.

Association of Railway Telegraph Superintendents.—P. W. Drew, 112 West Adams St., Chicago.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York. Summer meeting, June 25-26, Charlevoix, Mich.

ASSOCIATION OF WATER LINE ACCOUNTING OFFICERS.—W. R. Evans, Chamber of Commerce, Buffalo, N. Y. Annual meeting, October 8, Philadelphia, Pa.

BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION.—H. A. Neally, Joseph Dixon Crucible Co., Jersey City, N. J. Meeting with American Railway Bridge and Building Association.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 2d Tuesday in month, except June, July and Aug., Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursday, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan. and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—L. S. Pomeroy, Old State Capitol building, St. Paul, Minn.; 2d Monday, except June, July, August and September, St. Paul.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, Oliver building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Richmond, Va.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—E. S. Koller, 226 W. Adams St., Chicago; Wed. preceding 3d Thurs., Chicago.

INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, 11, rue de Louvain, Brussels, Belgium. Convention, 1915, Berlin.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, 922 McCormick building, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—Wm. Hall, 829 West Broadway, Winona, Minn. Next convention, July 15-18, Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio. Annual meeting, August 18, Richmond, Va.

MAINTENANCE OF WAY & MASTER PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—W. G. Wilson, Lehigh Valley, Easton, Pa.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Annual meeting, September 9-12, Ottawa, Can.

NATIONAL RAILWAY APPLIANCE ASSOC.—Bruce V. Crandall, 537 So. Dearborn St., Chicago. Meetings with Am. Ry. Eng. Assoc.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

NORTHERN RAILROAD CLUB.—C. L. Kennedy, C., M. & St. P., Duluth, Minn.; 4th Saturday, Duluth.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, Union Station, Peoria; 2d Thursday.

RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 2 Rector St., New York. Annual dinner, second week in December, 1913, New York.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Penna. R. R., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.

RAILWAY ELECTRICAL SUPPLY MANUFACTURERS' ASSOC.—J. Scribner, 1021 Monadnock Block, Chicago. Meetings with Assoc. Ry. Elec. Engrs.

RAILWAY GARDENING ASSOCIATION.—J. S. Butterfield, Lee's Summit, Mo. Next meeting, August 12-15, Nashville, Tenn.

RAILWAY DEVELOPMENT ASSOCIATION.—W. Nicholson, Kansas City Southern, Kansas City, Mo.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa. Convention, October 14, Nashville, Tenn.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

RAILWAY SUPPLY MANUFACTURERS' ASSOC.—J. D. Conway, 2135 Oliver bldg., Pittsburgh, Pa. Meetings with M. M. and M. C. B. Assocs.

RAILWAY TEL. AND TEL. APPLIANCE ASSOC.—W. E. Harkness, 284 Pearl St., New York. Meetings with Assoc. of Ry. Teleg. Sups.

RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—L. C. Ryan, C. & N. W., Sterling, Ill. Convention, September 8-12, 1913, Chicago.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.

SIGNAL APPLIANCE ASSOCIATION.—F. W. Edmonds, 3868 Park Ave., New York. Meetings with annual convention Railway Signal Association.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.

TOLEDO TRANSPORTATION CLUB.—J. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.

TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo Iron Works, Hillsburn, N. Y. Meeting with Roadmasters' and Maintenance of Way Association.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Erie, Pittsburgh, Pa.; meetings monthly, Pittsburgh.

TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library building, St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago. Annual meeting, June 17, Los Angeles, Cal.

TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Annual meeting, August, 1913, Chicago.

UTAH SOCIETY OF ENGINEERS.—R. B. Ketchum, University of Utah, Salt Lake City, Utah; 3d Friday of each month, except July and August.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Monday in month, except July and August, Chicago.

Traffic News.

The new schedule for the new extra-fare Overland Limited of the Chicago & Northwestern and Union Pacific which went into effect, Sunday, June 8, decreases the time between Chicago and San Francisco another hour. The running time is now 63 hours and 30 minutes.

The New York State Public Service Commission, Second district, which has authority over telephone rates throughout the state, including New York City, last week issued an order reducing toll rates for long distances in New York City from 10 cents to 5 cents, to such an extent, it is said, that the reduction in the receipts of the company will amount to $750,000 a year. The telephone company had already signified its acquiescence in this order.

The Empire Express Company, a new independent organization in Texas, is the defendant in a case recently filed in the Federal District Court at Dallas, to test the legality of an exclusive contract with a railroad. The proceedings are in the nature of an application for injunction by the Missouri, Kansas & Texas against itself to restrain it from receiving express packages from the Empire Express Company and also restraining the express company from offering such packages for transportation. The defendant claims that the exclusive contract with another express company, upon which the railroad bases its application, is in violation of the laws and constitution of the state of Texas.

INTERSTATE COMMERCE COMMISSION.

The commission has suspended from June 20 until December 20, certain advances in rates for the transportation of potatoes from points in Oklahoma to points in Colorado.

The commission has suspended from June 23 until December 23, certain advances in rates on lumber from points in Texas, Louisiana and Arkansas to destinations in Oklahoma and Missouri.

The Commerce Commission has suspended from June 18 until September 12 the operation of an item in Supplement No. 1 to Hocking Valley tariff No. 1534, containing a proposed increase in the charge for the privilege of fabrication in transit at Toledo of structural iron and steel.

Cotton Seed Rates.

Refuge Cotton Oil Company et al v. St. Louis, Iron Mountain & Southern et al. Opinion by Commissioner Meyer:

The complainant contends that the rates on cotton seed from points on the St. Louis, Iron Mountain & Southern in Arkansas and Louisiana to Vicksburg, Miss., are unreasonable as compared with rates on the same commodity to St. Louis, Mo.; Memphis, Tenn.; and Natchez, Miss., and asks that just and reasonable rates be established. The commission decided that the rates in question were unreasonable and that the remedy which the complainant seeks could be found only in the establishment of joint through rates. As the complainant did not request the establishment of such rates, no orders could be issued, but the commission recommended that certain joint through rates be established. (27 I. C. C., 117.)

Coal Rates Not Increased.

Shoal Creek Coal Company v. Toledo, St. Louis & Western et al. Opinion by the commission:

The complainant contends that the rates on bituminous coal from Panama, Ill., to points on the west bank of the Mississippi river, are unreasonable. On December 1, 1910, these rates were increased and the complaint is directed against these advances. The commission decided that the advances had not been justified and ordered that in future the same rates should be charged as those in effect prior to December 1, 1910. (27 I. C. C., 107.)

Lumber Rates from Southern Mills Sustained.

Suspension Docket No. 145. Opinion by Commissioner McChord:

Proposed increased rates on lumber in carloads from certain

groups in southeastern territory (Florida, Georgia and Alabama) to Washington, Baltimore, and points related thereto, and to certain points in New Jersey, not found to be unreasonable or unjustly discriminatory. Order of suspension vacated. As to certain rates the protests (filed last August) were withdrawn, and the principal contention remaining was as to the reasonableness of the increased rates to Washington, Baltimore and intermediate stations. The increases were from 1 to 4 cents per 100 lbs.

The proposed tariffs, generally, establish the same rates to Washington, Baltimore, and all intermediate stations on the Baltimore & Ohio. At the present time the rates to Washington proper are higher than to stations on the line of the Baltimore & Ohio Railroad immediately beyond Washington as far as Hyattsville and Alexandria Junction, Md.; the rates to Washington are the same as to stations on the Baltimore & Ohio between Alexandria Junction and Relay; and these Washington rates are higher than the rates to stations Relay to Baltimore, inclusive. At the present time, and for some years past, the rates to stations on the Philadelphia, Baltimore & Washington between Washington and Baltimore are and have been the same as the proposed rates. From some of the points of origin here in issue and from a large part of the southern territory, the Seaboard Air Line has had in effect since September 10, 1910, rates to Baltimore & Ohio stations east of Washington, including Alexandria Junction and Hyattsville, the same as the rates here suspended.

The grounds upon which the carriers seek to show that these proposed increased rates are just and reasonable are that they were published to establish rates in line with the normal basis between the points named, the same as the rates now in force via the Seaboard Air Line and the same as now apply to stations between Washington and Baltimore on the line of the Philadelphia, Baltimore & Washington; to eliminate certain violations of the fourth section of the act at destination points; and to correct clerical errors in the present tariffs. As a part of their defense the respondents show the revenues per ton per mile the proposed rates would yield, and compare these ton-mile earnings with those now received under the rates from the same general territory of origin to central freight association territory.

The protestants claim that the maintenance of the present rates to Washington and Baltimore for a long period has resulted in an adjustment of commercial conditions that should not be disturbed, and that the rates to Baltimore may well be less than to Washington in view of its location and the possibility of water competition. To this the respondents reply that the present rates to Baltimore were erroneously constructed in the first instance by using, on traffic moving through Richmond, the divisions applicable to Norfolk; that the divisions on lumber up to Norfolk accruing out of all rates to eastern points have never properly been applicable to Baltimore; and that while Baltimore is a great port it has never been called a water-competitive point, because that term in this territory is restricted to points on or served in connection with the New York, Philadelphia & Norfolk.

The unweighted average distance from 17 of the more important points of origin served by the Southern Railway to Washington is 792 and to Baltimore 832 miles. The average revenue per ton per mile on this traffic from these points, if the proposed rates be permitted, will be 6.58 mills to Washington and 5.63 mills to Baltimore. Comparing these distances and revenues with those from the same points of origin to Springfield, Ohio, the respondents show that the average short-line distance is 691 miles and the average revenue per ton per mile on the rates now in force 7.64 mills. For the Central of Georgia it was shown that from 13 representative points in the various groups served by it the average short-line distance to Baltimore is 887 miles and to Washington 847 miles. The proposed rates would yield an average ton-mile revenue of 5.55 mills to Baltimore and 5.75 mills to Washington. These distances and revenues are compared with the short-line distances to Dayton and Columbus, Ohio, and to Indianapolis and Logansport, Ind., from the same 13 points. The average distance from these points of origin to these four points of destination is 794 miles, and the average revenue per ton per mile 6.57 mills. For the Atlantic Coast Line it was shown that from 12 representative points of origin served by it to Baltimore the average distance is 849 miles and the average ton-mile revenue 5.77 mills. Apparently to Washington the average distance is 809 miles, and the average revenue under the proposed rates would be 6.05 mills.

No part of the advances here involved will accrue to the lines north of Richmond and Potomac Yards. The southern roads, on whose lines the traffic originates, proposed the rates here considered and will receive whatever additional revenue may be produced. Respondents have sustained the burden of proof, and a careful investigation of the record failing to show unreasonableness or unjust discrimination in the proposed rates it follows that the order of suspension should be vacated. (27 I. C. C., 189.)

Coke Rates Reduced.

Coke Producers' Association of the Connellsville Region v. Baltimore & Ohio et al. Opinion by Chairman Clark:

Rates on coke in carloads from the Connellsville producing region of Pennsylvania to various destinations are attacked as unreasonable *per se*, unjustly discriminatory, and unduly preferential. The commission holds:

1. That the rates to Youngstown, Canton, Cleveland and Toledo, Ohio; North Cornwall, Robesonia, Reading and Philadelphia, Pa.; Baltimore, Md.; and Newark, N. J., are unreasonable *per se*.

2. That the present relationship of rates as between the Connellsville district and the Fairmont district in West Virginia is not unduly discriminatory against Connellsville or unduly preferential to Fairmont and must be maintained.

3. That participation by defendants in through rates from West Virginia and Tennessee fields, which yield lower earnings per ton-mile than their rates from the Connellsville field, is, under the conditions of competition between carriers which defendants cannot control, neither unduly discriminatory nor unduly preferential.

In its conclusion the commission says:

"In this and in other cases herein referred to, the rates upon a vast tonnage are involved. We feel impelled to give most careful consideration to the effect which changes will have upon the carriers' revenue. Under the circumstances we would not feel warranted in requiring the serious reductions that have been sought unless it were necessary in order to remove unjust discrimination or to correct manifest unreasonableness. There is nothing here to indicate that the volume of traffic will be augmented by drastic reductions in these rates or change in the relationship as between Connellsville and Fairmont. Other carriers have heretofore maintained, to markets that could thus be reached from other districts, rates approximately equal to those from Connellsville, and there is no reason to assume that they will surrender that traffic and allow the industries served by them to die rather than to meet reduced rates from Connellsville. Manifestly, the loss of revenue which would result from drastic reductions in the rates upon the tonnage involved in these cases cannot be compensated for by increases in rates upon other traffic.

The commission orders that the defendants (16 roads) desist, on or before August 1, 1913, and for a period of two years thereafter from charging their present rates for the transportation of coke in carloads from the Connellsville region to the various destinations in Ohio, Pennsylvania, Maryland and New Jersey named below, and that they establish, on or before August 1, 1913, the following rates (in dollars per net ton): Youngstown, Ohio, $1.20; Canton, Ohio, $1.40; Cleveland, Ohio, $1.60; North Cornwall, Pa., Baltimore, Md., and Robesonia, Pa., $1.80; Reading, Pa., and Toledo, Ohio, $1.85; Philadelphia, Pa., $2.05; and Newark, N. J., $2.30. It is further ordered that they apply to the transportation of coke in carloads from the Fairmont district of West Virginia to the said destinations the same relation of rates that at present exists, which relation is found to be reasonable. (27 I. C. C., 125.)

Youngstown Sheet & Tube Company et al. v. Pittsburgh & Lake Erie. Opinion by Chairman Clark:

Complaint attacks the rate on coke from Connellsville to points in the Mahoning Valley of Ohio and the Shenango Valley of Pennsylvania as unreasonable *per se*. Reparation is sought. It is held that following the decision in the case above reported (27 I. C. C., 125) the rate of $1.35 per net ton from Connellsville district to points in the Mahoning Valley of Ohio is unreasonable to the extent that it exceeds $1.20. Transportation to points in the Shenango Valley is not within the commission's jurisdiction. In the case above noted a general readjustment of rates on coke is prescribed, and under such new adjustment reparation will not be awarded. (27 I. C. C., 165.)

Coke Rates Sustained.

Wickwire Steel Co. et al. v. New York Central & Hudson River et al. Opinion by Commissioner Meyer:

The present rates for transportation of coke from the Connellsville fields in Pennsylvania to Buffalo, N. Y., not found unreasonable; complaint dismissed. (27 I. C. C., 168.)

Wisconsin Steel Company v. Pittsburgh & Lake Erie, et al; same v. Pennsylvania Railroad et al; Inland Steel Company v. Pittsburgh & Lake Erie et al. Opinion by Chairman Clark:

After maintaining for a substantial period rates on coke from the Connellsville producing region in Pennsylvania to Chicago of $2.35 per ton when for furnace use, and $2.65 per ton when for foundry use, defendants, in conformity with ruling of the commission, abandoned the maintenance of rates dependent upon the use to which the commodity was put, and established a rate of $2.50 per ton from Connellsville to Chicago. Complaints attack the rate of $2.50 per ton as unreasonable, and pray for reparation; it is held that the rate of $2.50 per ton is not unreasonable *per se*, and the complaints are dismissed. (27 I. C. C., 151.)

Iron Ore Rates Found Unreasonable.

Pittsburgh Steel Co. v. Lake Shore & Michigan Southern et al. Opinion by Commissioner Meyer:

After careful deliberation upon all the elements in this case, together with a consideration of the relation of this case to all the other cases in the group of which it is one, and which together affect the vital part of the total traffic of all these carriers, it is held, that the rate on iron ore from Lake Erie ports to the Pittsburgh district should not be higher than to the Wheeling district, and an order is issued requiring the rates to be readjusted by August 15. (27 I. C. C., 173.)

Rates on Glass to High Point Found Too High.

Standard Mirror Company et al. v. Pennsylvania Railroad et al. Same vs. Lake Shore & Michigan Southern et al., and Snow Lumber Company et al. v. Pennsylvania Railroad et al. Opinion by Commissioner Meyer:

Present rates on window glass, rolled glass and plate glass from Pittsburgh, Pa., to High Point, N. C., found unreasonable to the extent that they exceed 40 cents per 100 lbs. on window glass and rolled glass, and 53 cents on plate glass. Present rate on plate glass from Toledo, Ohio, to High Point, N. C., found unreasonable to the extent that it exceeds 64½ cents per 100 lbs. The former differential from Reynoldsville, Pa., on window and rolled glass of 1 cent over Pittsburgh should be maintained. Upon receipt of proper statements prepared by complainants and verified by defendants, the commission will issue orders of reparation. It is expected that the carriers will correct their tariffs by July 15; if they do not an order will be issued. (27 I. C. C., 200.)

Complaint Dismissed.

Merchants Freight Bureau of Little Rock, Ark., v. Waterloo, Cedar Falls & Northern et al. Opinion by the commission:

The complainant contends that the rates on canned goods in carloads from points in Iowa to Little Rock and Pine Bluff, Ark., are unreasonable. These rates were increased in May, June and July, 1912, the advances ranging from 5 to 7 cents per 100 lbs. The commission decided that the advances in the rates in question had been justified. (27 I. C. C., 111.)

STATE COMMISSIONS.

The Railroad Commission of Louisiana has ordered the Yazoo & Mississippi Valley to enlarge and improve its pagoda at Gurley. Pagoda, we infer, means flag station.

The Louisiana Railroad Commission will hold a hearing on June 24, at which the matter of whether or not the commission shall issue a compulsory order to install block signals will be considered. The commission hopes to issue at that time a final order.

Chairman O. F. Berry, of the Illinois Railroad & Warehouse Commission, has been investigating for several weeks the conditions with reference to the demand for and the supply of grain cars throughout the state, and, as a result he says that Illinois roads are not equal to the demands made upon them for cars of this kind.

The Montana Railroad Commission has filed a protest with the Interstate Commerce Commission against an increase in passenger rates from points in Montana to points in Wisconsin, Illinois and other eastern states, which amounts to about $2 over present rates, and was to have gone into effect July 1. An investigation of the reasonableness of the proposed increase is asked.

The Railway Commission of Canada has called upon the railway companies to show cause why the commission should not issue an order requiring all roads within three years to install interlocking signals at grade crossings of one railway with another, and also at all crossings of electric roads. The commission "is impressed with the large number of accidents occurring at grade crossings of one road with another."

The Kansas Public Utilities Commission on June 9 denied the application of the railroads of Kansas to increase the minimum carload weights on grain, grain products, salt, cement, and a number of other commodities, holding that if the application were allowed the increase would work a hardship on the small dealer, because the present minimum of these commodities is the maximum amount that the small dealer can buy.

The Public Service Commission of Missouri on June 13 made public its report on a butting collision between passenger trains at Brant Sidings, Mo., on the Missouri Pacific, May 27, in which four persons were killed. The cause was negligence of a train despatcher in giving conflicting orders and the failure of a block signal operator in block working. The commission recommends that employees be instructed every six months in the operation of the manual block system.

The railroad commissioners of Massachusetts reporting on a collision which occurred on the New York, New Haven & Hartford, near Braintree, Mass., April 28—a butting collision between a local passenger train and a work train in a fog—orders the road forthwith to install block signals on the West Quincy branch, 5½ miles long, the style and location of signals to be subject to approval of the commission. The cause of the collision was failure of an engineman to look at a train register and failure of conductor and engineman to identify a passenger train. They saw train No. 5011 and assumed that it was 5037.

The Kansas Public Utilities Commission finds four causes for the annual car shortage. These are: (1) Failure of the carriers to add to their equipment proportionately with the increase of freight tonnage; (2) and to secure maximum use of the cars which they have; (3) the practice of consignees in using cars for storage purposes; and (4) the practice of farmers in selling their grain from the machine. "After reading practically everything that has been said," says the commission, "we are unable to discover a single suggestion that points to a remedy. The railroads can lessen the trouble by increasing the number of cars and improving the efficiency of their management; the millers and elevator men by being more expeditious in loading and unloading, and the grain grower by delaying the shipment of his grain."

C. M. Larson, assistant chief engineer of the Wisconsin State Board of Assessment and of the Railroad Commission of Wisconsin, has been appointed chief engineer, with headquarters at Madison, Wis., succeeding Professor W. D. Pence. Mr. Larson was born in 1874 in Wisconsin. He was graduated from the University of Washington in 1899, and from the University of Wisconsin in 1905. He became connected with the Wisconsin State Board of Assessment in 1903 as assistant inspector on steam railroad valuation and special investigations of land values. During 1905-06 he was in Mexico on railroad construction work for a year. He then returned to the Wisconsin State Board of Assessment, and the railroad commission. He was appointed real estate engineer of the Chicago & Alton; Toledo, St. Louis & Western; Minneapolis & St. Louis and the Iowa Central in 1909, remaining with those roads until 1911, when he returned to the Wisconsin State Board of Assessment.

Car Balance and Performance.

Arthur Hale, chairman of the committee on relations between railroads of the American Railway Association, in presenting statistical bulletin No. 146, covering car balances and performances for February, 1913, says:

The miles per car per day, for February were 24.7, compared with 24.3 for January. This figure for February, 1912, was 22.9.

Ton miles per car per day, for February were 395, compared with 392 in January. This is an increase of 6.76 per cent. over the figure for February, 1912, which was 370.

The proportion of home cars on line increased one point over January, 1913, which was 51 per cent. This figure for February, 1912, was 54 per cent.

The per cent. of loaded mileage for February was 70.1 per cent., compared with 68.5 per cent. in January, 1913. This figure for February, 1912, was 71.9 per cent.

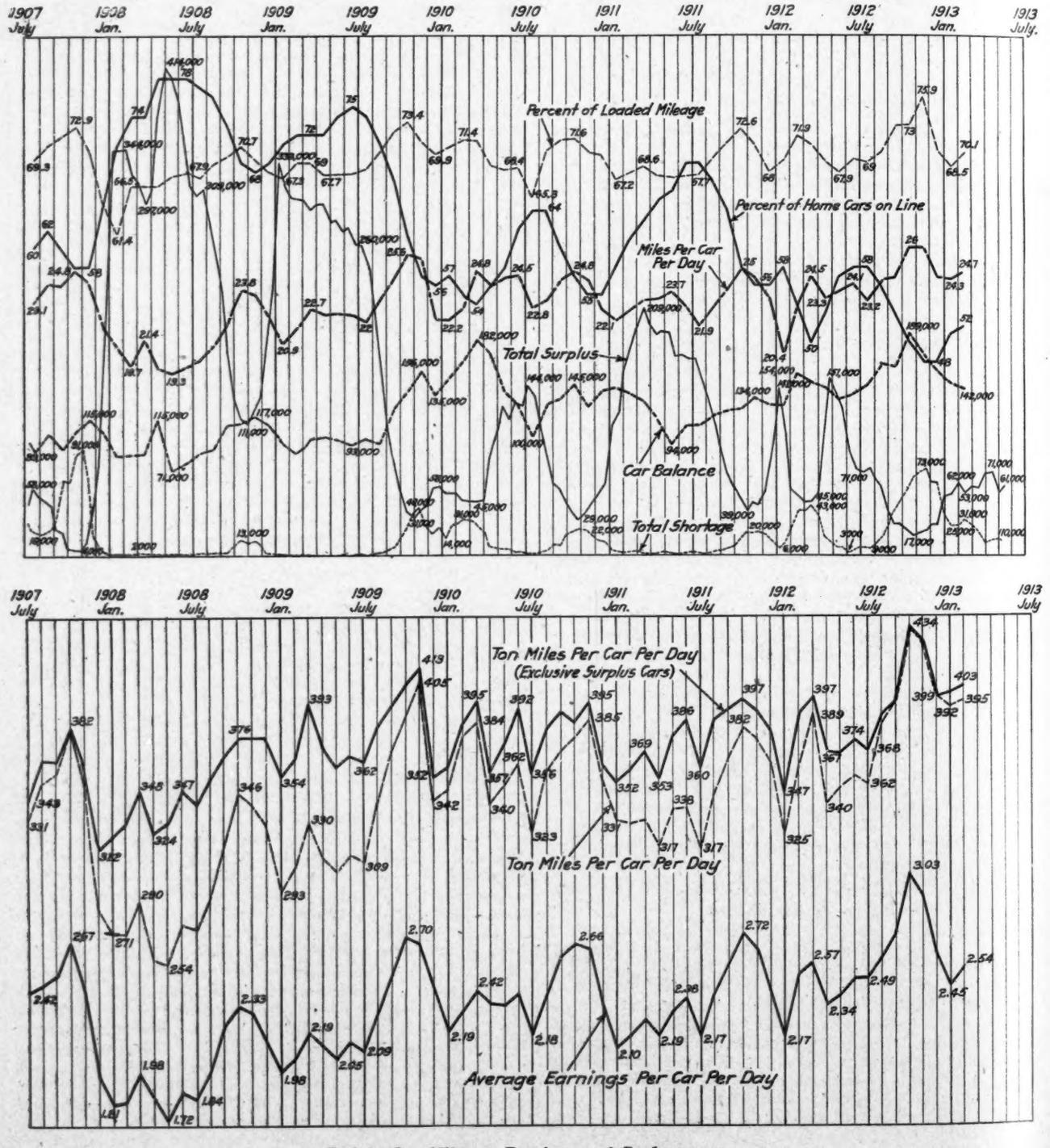
The average earnings per car per day for all cars on line were $2.54. This is an increase of 3.67 per cent. over the figure for January, 1913. This figure for February, 1912, was $2.49.

The table gives car balance and performance in the month covered by the report, and the diagrams show car surpluses, car shortages, car earnings and car mileage and different car performance figures monthly from July, 1907.

In bulletin No. 144, covering car balances and performances for January, 1913, Mr. Hale commented on the first diagram as follows:

Attention is called to the diagram which shows graphically the relation between car surplus and shortage with car balance, the cars away from home and the general performance of cars.

It will be noted that when there is a large car surplus the percentage of home cars on line is large, as the surplus drops this percentage decreases, that is, cars begin to go away from



Freight Car Mileage, Earnings and Performance.

CAR BALANCE AND PERFORMANCE IN FEBRUARY, 1913.

	New England.	N. Y., N. J., Del., Md., Eastern Pa.	Ohio, Ind., Mich., Western Pa.	Va., W. Va., No. and So. Carolina.	Ky., Tenn., Miss., Ala., Ga., Fla.	Iowa, Ill., Wis., Minn.	Mont., Wyo., Neb., Dakotas.	Kan., Colo., Okla., Mo., Ark.	Texas, La., New Mex.	Ore., Idaho, Nev., Cal., Ariz.	Canadian Lines.	Grand Total.
Revenue freight cars owned	88,749	681,467	221,913	189,085	172,403	420,255	17,955	143,536	29,305	134,636	132,866	2,232,170
Average number of system cars on line	43,090	335,437	108,213	95,091	70,459	263,939	4,058	61,865	17,883	59,703	86,734	1,146,472
Railway-owned cars: Average foreign on line	56,158	316,556	115,095	91,161	85,370	167,770	11,189	76,773	26,599	52,840	55,226	1,054,737
Total Railway-owned cars on line	99,248	651,993	223,308	186,252	155,829	431,709	15,247	138,638	44,482	112,543	141,960	2,201,209
Excess	10,499	*29,474	1,395	*2,833	*16,574	11,454	*2,708	*4,898	15,177	*22,093	9,094	*30,961
Per cent. of cars on line to total owned:												
Home	49	49	49	51	41	63	23	43	61	45	65	52
Foreign	63	46	52	48	49	40	62	49	91	39	42	47
All railways	112	95	101	99	90	103	85	92	152	84	107	99
Private cars on line	4,027	38,425	10,872	6,712	9,256	14,849	1,263	7,468	4,059	13,772	3,287	113,990
Total, all cars on line	103,275	690,418	234,180	192,964	165,085	446,558	16,510	146,106	48,541	126,315	145,247	2,315,199
Per cent. of cars in shop	6.70	5.43	8.59	5.62	8.23	5.47	8.77	6.50	5.79	5.02	5.03	6.17
No. of freight engines owned	1,430	10,359	3,266	3,463	2,917	6,976	545	2,848	846	2,792	2,166	37,608
Average cars on line per freight engine owned	72	67	72	56	57	64	30	51	57	45	67	62
Total freight-car mileage	51,238,980	487,245,231	146,028,015	139,980,352	122,448,516	290,999,903	21,284,624	89,214,963	35,697,233	111,057,848	91,656,608	1,586,852,273
Average mileage per car per day	17.7	25.2	22.0	25.9	26.6	24.3	47.5	23.0	26.7	31.3	22.5	24.7
Per cent. loaded mileage	73.2	67.3	69.8	67.0	73.2	72.2	77.4	70.7	63.7	69.5	78.4	70.1
Ton-miles of freight, including company freight	618,992,977	8,289,208,001	2,353,747,450	2,246,498,138	1,927,860,886	3,488,282,734	346,694,829	1,340,966,857	399,733,752	1,680,616,266	1,528,955,421	24,221,557,311
Average ton-miles, including company freight:												
Per car-mile	12.1	17.0	16.9	16.0	15.9	14.6	16.8	15.0	13.5	15.4	16.7	15.9
Per loaded car-mile	16.5	25.3	24.3	23.9	21.7	21.0	21.7	21.4	20.7	22.2	21.3	22.9
Per car per day	214	429	372	416	422	353	798	345	360	483	376	395
Gross freight earnings	$6,574,720	$45,624,369	$13,010,439	$13,255,400	$12,510,731	$29,668,035	$2,559,300	$11,379,226	$3,961,504	$15,761,189	$10,448,286	$164,753,199
Average daily earnings: Per car owned	$2.65	$2.39	$2.09	$2.51	$2.59	$2.52	$5.09	$2.73	$4.83	$4.20	$2.81	$2.63
Per railroad car on line	2.37	2.54	2.08	2.54	2.87	2.45	5.99	2.97	3.18	5.03	2.63	2.68
All cars on line	2.27	2.36	1.98	2.45	2.71	2.37	5.54	2.83	2.91	4.48	2.57	2.54

*Denotes deficiency.

home. After the surplus has reached a minimum and has begun to increase, the cars start home again.

If there were an equal interchange of cars, the car balance would, of course, remain constant, but with our present unequal interchange the originating roads do not receive an equivalent in cars as their own cars begin to leave home, and therefore when the surplus has dropped the car balance rises. The balance against the originating roads reaches a maximum before the minimum percentage of home cars on line is reached. Apparently the originating roads are enabled to hold on to foreign cars more effectually when surpluses are at a minimum.

The shortages, of course, become marked only after the surpluses are well reduced, so that the shortage line has points of resemblance with the car balance.

The succession seems to be: First, a reduction in the surplus; second, the cars leave home; third, the car balance is seriously affected; fourth, a car shortage develops; fifth, the car balance improves; sixth, the cars begin to go home again; seventh, the shortage diminishes; eighth, a surplus comes again The other two lines showing miles per car per day and the percentage of loaded mileage follow very closely the lines of car shortage, that is, when cars are most needed, they are moved fastest and loaded oftenest, and this happens in the periods when a maximum number of them are away from home.

Certain seasonal conditions are manifest. There is always a shortage in October and November. Even in 1908 there was a little one. There is generally a shortage in March. In 1911-12 it was bigger than the October shortage. And these are the months of good mileage and heavy loaded mileage, and the times when cars are away from home. There are also general tendencies noted between 1907 and 1913. Cars leave home more year by year, the car balance tends to increase, the percentage of loaded mileage increases and so do the miles per day.

This looks like greater efficiency.

COURT NEWS.

Court of Claims Reverses Postmaster General's Weighing Orders of 1907.

In an opinion handed down June 2, the Court of Claims, at Washington, decides in favor of the Chicago & Alton in its suit to recover additional compensation for the carrying of the mails from July 1, 1907, to April 30, 1911, the suit being based on the charge that from the date first named the weighing of the mails had not been carried out in accordance with the law; and the amount of reparation awarded is $82,605. The government has appealed from this decision to the Supreme Court. If the decision is sustained other roads will also recover and it has been estimated that the aggregate amount of reparation, for the four years during which the compensation of the railways has been calculated on the wrong basis, will amount to $20,000,000.

The annual compensation made to railways for carrying the United States mails is based on the average weight per day and the number of miles carried; and prior to the issuance of the orders in question the average was ascertained by weighing the mails during periods of 105 days every four years. The weight having been thus ascertained the total was divided, not by 105 but by 90, Sundays being excluded. For a single week the weight could be ascertained for 7 days and the total divided by 6. The second and final order which was issued by Postmaster General Von Meyer was No. 412, dated June 7, 1907, and was to the effect that the whole number of days included in the weighing period should be used as a divisor for obtaining the average weight per day; in other words, by a stroke of the pen, the postmaster general reduced the pay of the railways about 8 per cent.

In its discussion of the case the Court of Claims goes back to the year 1867. The earlier practice of dividing by 6 rather than 7 is sustained by the court mainly on the ground that the practice had been of long standing, was fully known to Congress, as shown by debates on appropriation bills, and was more reasonable than the 7-day arrangement.

The postoffice department first weighed the mails systematically in 1867. The weighing period was five weeks and the aggregate was divided by 30. This was the practice until July 1, 1873. In that year the law was amended and the statute required the weighing of the mails for at least 30 successive working days, and at least every 4 years. Prior to 1876 the weighing was done

by the railroads, but after that by the postoffice employees. Sunday mail trains were not numerous in 1873; but the practice of weighing for 7 days and dividing by 6 was continued for more than 30 years, until the issue of the special order referred to in 1907. In 1881 and 1884 the postmaster general, in reporting to Congress, explained the workings of the law, and a bill was introduced in the house cutting out the word "working" from "working days," but no action was taken on the bill. The postmaster general issued an order to divide by 7 instead of 6, away back in 1884, but the attorney general advised that the old practice was correct and this order was never put into effect. But another attorney general, 20 years later, said that the old plan was based on "an impossible construction of the law" of 1873. In 1885 the postmaster general again, complying with a resolution of the Senate, sent to Congress a detailed history of the railway mail service, calling attention to this detail. The appropriation act of 1905 again used the term "successive *working* days," and thereafter, in compliance with the law, the postmaster general had the mails weighed 105 days, once in 4 years, and used as the divisor 90. In the appropriation bill of 1907 it was proposed in the house to again direct the use of the larger divisor, but, after a good deal of discussion, the bill was passed without this provision. Then the postmaster general issued the order making the change.

The decision, by Justice Barney, says that the word "working" was doubtless used to designate particular days; if Congress had not intended to exclude Sundays why did it use that word? To weigh the mail for 35 days, including Sundays, and then divide by 35 would be unjust to roads which ran no mail trains on Sunday. If the mails had not been weighed on Sundays injustice would have been done to the roads carrying mails on that day.

A fair examination of the law of 1873, taking into consideration all of the circumstances then existing, shows that it was designed to provide payment upon the basis of the average weight of mails carried on six days, leaving to the postmaster general the problem of doing justice to those roads which carried mails on Sundays. He did this in the way before described. Even if some other reasonable basis could be calculated, the court thinks that the long continued construction given to the law, in the administration of the postoffice department, was equivalent to writing this method into the law. And, Congress having continued to make appropriations with full knowledge of the situation, it is to be assumed that Congress approved of the course taken by the postoffice department. The decision then goes on to cite many authorities to the effect that where a statute is ambiguous the uniform practice of the department in carrying out the law must be accorded much weight by the courts.

Prior to 1907 the laws had specified a *maximum* rate for the transportation of the mails and the postmaster general had some discretion; and he had always paid the full maximum; but in that year the law was made absolute; the pay on such and such routes "shall be," etc. Congress having thus made an absolute rate, and the order of June 7 having been found contrary to law, and therefore no regulation at all, the court sustains the Chicago & Alton claim.

State Rate Laws Sustained.

The Supreme Court of the United States this week rendered decisions in the remaining 22 cases, known as the Missouri rate cases. These opinions, handed down by Associate Justice Hughes were comparatively brief, following the principles laid down in the Minnesota decision reported last week.

The state laws of Missouri, Oregon, Arkansas and West Virginia were upheld. In the case of three roads in Missouri, where the state rates manifestly would result in confiscation, those rates were declared confiscatory but with permission to take future action as in the case of the Minneapolis & St. Louis.

The legislation dealt with in these decisions included the two-cent passenger laws in Missouri, Arkansas and West Virginia; maximum freight rate laws in Missouri and Arkansas and freight rates out of Portland in the Oregon cases. The only exception to the sweeping approval of state statutes was in the case of several weaker roads in Missouri. The West Virginia case was originally brought by the Chesapeake & Ohio to restrain the enforcement of the 2 cent fare law of that state passed in 1907.

The Oregon cases were brought to restrain the enforcement of an order of the State Railroad Commission made April 22, 1908, prescribing freight rates, and another similar order, made September 21, 1910. The question of confiscation did not arise in these cases. The Arkansas decision sustains the act of 1907 fixing passenger fares at 2 cents a mile, and orders of the railroad commission, made in June, 1908, prescribing maximum rates for both freight and passengers.

Justice Hughes in announcing the decisions referred back to the Minnesota cases wherever the point was raised that the state laws interfered with interstate commerce.

"We need not review the arguments addressed to conditions of transportation in Missouri and the relation of intrastate to interstate rates," he said, "for while the case has its special facts by reason of location of the state and the use of the Mississippi and Missouri rivers as basing points the controlling question is not to be distinguished from that which was decided in the Minnesota rate cases."

The Oregon and West Virginia cases were decided in favor of the states in a few words, the only point raised by the railroads being that the laws interfered with interstate commerce. Justice Hughes went fully into the claims in the Missouri and Arkansas cases.

As a result of the court's action in the Missouri cases the state-prescribed rates will go into effect on the Chicago, Burlington & Quincy, the Atchison, Topeka & Santa Fe, the Kansas City Southern, the Missouri, Kansas & Texas, the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, the St. Louis Southwestern, the Missouri Pacific, the St. Louis, Iron Mountain & Southern, the Wabash, the Chicago, Milwaukee & St. Paul and the Chicago & Alton. For the present the rates will not become operative on the St. Louis & Hannibal, the Kansas City, Clinton & Springfield, the Chicago Great Western, the Quincy, Omaha & Kansas City, and the St. Joseph & Grand Island.

The court refused to accept the valuation placed on railroads in Missouri by the state's assessing board as a basis for fixing "the fair value" for rate making. Justice Hughes took the case of the Burlington and showed that by applying the assessment value (multiplied three times as was done by the federal court in Missouri) to the whole system, a result would be obtained $115,000,000 in excess of the capitalization of the system. Besides, he said, there was nothing to show upon what the assessors fixed their valuation, nor was it demonstrated that the assessors avoided the mistakes criticised in the Minnesota rate decision.

"Manifestly, a finding of confiscation would not be based on such a valuation, in the absence of clear and convincing proof that the values actually existed and that the different items of property were estimated by correct methods and in accordance with proper criteria of value. . . . The proof was lacking. In the case of the other roads, although the special considerations applying to the Burlington property may not be applicable, still we are left in uncertainty as to the correctness of specific valuations which have been made." Apportionment of property values between interstate and intrastate passenger and freight traffic according to gross revenue was disapproved "for reasons stated in the Minnesota rate cases."

Justice Hughes said that the plan adopted by the lower court of applying the revenue basis in apportioning expenses was open to the same objection as in the Minnesota cases. However, as to the St. Louis & Hannibal and the Kansas City, Clinton & Springfield, he said, the experts of both the state and the railroads united in declaring that no basis could be found upon which the proposed rates would yield an adequate return. As to the Chicago Great Western, he said, errors of valuation and apportionment were not sufficient to warrant a reversal of the finding of the lower court that the rates were confiscatory. The rates as to the Quincy, Omaha & Kansas City and the St. Joseph & Grand Island were annulled because of a stipulation between the state and the railroads that the finding as to the Chicago Great Western should control them.

The Kentucky case was not decided. It involves an attack upon state rates from river points to inland distillery cities and involves in addition an attack on the constitutionality of the law enabling the state railroad commission to fix reasonable rates on intrastate commerce. The court adjourned until next October without announcing a decision in the intermountain rate cases.

REVENUES AND EXPENSES OF RAILWAYS.

TEN MONTHS OF FISCAL YEAR, 1913.

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Trans-portation.	General.	Total.					
Atlanta & West Point	93	$542,498	$408,606	$1,052,514	$127,642	$191,643	$53,371	$341,974	$49,616	$764,246	$288,268	$1,447	$63,439	$226,276	—$44,544
Atlanta, Birmingham & Atlantic	645	2,024,417	549,032	2,763,348	443,404	435,506	153,470	1,096,279	114,660	2,243,319	520,029	.....	135,562	384,467	124,689
Atlantic City	167	637,023	1,025,127	1,762,590	303,041	149,346	26,822	924,114	13,559	1,416,882	345,708	—32,086	90,000	223,622	—78,461
Belt Ry. Co. of Chicago	21	.....	.....	2,664,613	156,172	357,979	4,968	1,130,465	53,981	1,703,565	961,048	.....	80,444	880,604	89,321
Boston & Maine	2,244	23,994,095	13,394,083	40,491,208	4,763,641	6,423,303	347,106	19,481,334	1,020,547	32,035,931	8,455,277	147,330	1,790,720	6,811,887	—314,008
Buffalo & Susquehanna *R. R.*	265	1,399,679	83,467	1,524,909	286,499	227,854	12,168	525,980	59,235	1,111,736	413,173	.....	22,000	391,173	160,413
Buffalo & Susquehanna *Ry.*	91	419,841	92,440	537,000	115,368	279,796	4,704	228,952	26,195	655,015	—118,015	102	15,800	—133,713	—18,452
Butte, Anaconda & Pacific	74	886,957	109,467	1,094,718	129,684	220,383	7,142	534,422	29,739	921,370	173,348	.....	20,638	152,710	—20,935
Canadian Pacific Lines in Maine	233	883,625	319,328	1,303,845	270,498	190,147	59,974	544,991	51,373	1,116,983	186,862	.....	100,000	86,862	31,954
Central of Georgia	1,915	7,681,519	3,234,591	11,955,280	1,720,344	2,163,319	350,103	4,064,708	389,140	8,687,614	3,267,666	60,024	503,695	2,823,995	—296,062
Central of New Jersey	676	17,902,346	4,558,175	23,715,404	2,155,005	3,510,293	293,570	7,083,827	427,291	13,469,986	10,245,418	—60,004	1,238,800	8,946,614	933,203
Central Vermont	411	2,275,739	917,983	3,466,021	391,200	612,617	81,613	1,734,115	83,917	2,903,462	562,559	535	139,325	423,769	—135,765
Chesapeake & Ohio Lines	2,324	22,915,335	4,836,214	29,080,224	3,439,244	6,315,911	558,653	9,422,723	652,654	20,409,185	8,671,039	29,242	1,121,550	7,578,731	—1,226,120
Chicago & Erie	270	3,555,687	612,520	4,609,593	827,677	1,000,357	208,202	2,419,900	112,253	4,568,389	41,204	—7,140	134,685	—100,621	—379,532
Chicago, Indiana & Southern	359	3,282,676	253,999	3,676,680	472,641	915,103	81,244	1,268,321	97,850	2,835,159	841,521	3,765	164,836	680,450	275,358
Chicago, Indianapolis & Louisville	617	3,868,243	1,362,188	5,777,712	881,421	800,994	179,807	2,198,465	147,775	4,208,462	1,569,250	.....	236,883	1,332,367	60,719
Chicago, Peoria & St. Louis†	355	388,707	88,999	507,003	74,240	98,669	27,912	269,591	25,787	496,199	10,804	.....	17,200	—6,396	—23,739
Chicago, Rock Island & Pacific	7,566	37,266,383	15,967,469	56,730,774	8,077,989	8,164,229	1,561,657	23,192,422	1,394,728	42,391,025	14,339,749	—162,756	2,382,339	11,794,654	1,161,927
Chicago, Terre Haute & Southeastern	351	1,416,858	177,036	1,633,720	270,335	331,018	31,257	526,687	78,171	1,237,468	396,252	—2,385	100,000	293,867	—124,052
Cincinnati Northern	245	932,881	176,706	1,166,394	207,197	251,355	26,152	489,236	32,410	1,006,350	160,044	.....	54,862	105,182	10,419
Cleveland, Cincinnati, Chic. & St. Louis	2,014	19,284,749	6,509,900	28,173,897	3,729,605	5,441,058	713,465	11,212,795	574,846	21,671,769	6,502,128	—15,155	1,035,443	5,451,530	—473,611
Colorado & Southern	1,069	5,734,163	1,163,631	7,375,045	939,513	1,659,436	110,762	2,197,992	222,330	5,130,033	2,245,012	—9,464	292,909	1,942,639	18,486
Delaware & Hudson Co.—Railroad Dept.	854	16,864,817	2,592,533	20,137,997	1,590,979	2,955,140	232,783	6,885,893	577,750	12,242,545	7,895,452	—65,766	504,666	7,325,020	1,066,188
Denver & Rio Grande	2,550	15,387,886	4,374,003	20,667,140	2,690,766	3,766,373	458,768	6,670,453	567,350	14,153,710	6,513,430	—4,507	804,100	5,704,823	1,240,719
Denver, Northwestern & Pacific	215	668,906	237,842	950,284	159,099	169,329	19,999	329,434	49,794	727,655	222,629	.....	35,000	187,629	—50,886
Detroit & Toledo Shore Line	79	1,103,822	.....	1,108,025	121,091	60,723	12,213	314,043	23,495	531,565	576,460	.....	54,865	521,595	46,076
Detroit River Tunnel	2	.....	.....	1,068,638	22,425	28,470	.....	88,634	393	139,922	928,716	.....	49,508	879,208	—61,599
Detroit, Toledo & Ironton	441	1,151,232	128,050	1,384,781	345,975	308,880	26,449	695,769	52,829	1,429,902	—45,121	—12	57,000	—102,133	—254,365
Duluth & Iron Range	272	$4,805,065	$216,611	$5,114,361	$670,143	$560,434	$9,476	$1,199,632	$122,642	$2,562,327	$2,552,034	$11,320	$248,951	$2,314,403	—$24,684
Erie	1,988	33,268,943	7,808,744	44,700,654	4,759,542	8,020,998	977,891	15,098,629	898,987	29,756,047	14,944,607	—319,434	1,483,664	13,141,509	1,828,838
Galveston, Harrisburg & San Antonio	1,338	6,996,695	2,714,849	10,236,649	1,057,630	2,139,061	338,751	4,117,425	308,765	7,961,632	2,275,017	—36,326	314,025	1,924,666	316,834
Georgia	307	1,707,629	738,456	2,633,160	292,909	498,145	115,218	1,311,640	82,713	2,300,625	332,535	.....	29,907	302,628	—429,373
Georgia, Southern & Florida	395	1,190,076	710,693	2,174,825	261,536	406,669	77,845	873,978	93,187	1,713,215	461,610	—241	111,520	349,849	—29,248
Great Northern	7,764	48,201,143	12,434,980	64,848,951	9,030,711	7,926,750	1,002,293	17,878,085	1,079,666	36,917,505	27,931,446	104,295	3,285,142	24,750,599	2,639,812
Gulf, Colorado & Santa Fe	1,595	8,539,324	2,517,165	11,752,861	1,848,811	1,751,674	247,046	4,366,086	337,036	8,550,653	3,202,208	.....	397,091	2,805,117	763,720
Hocking Valley	352	5,145,003	782,354	6,338,692	649,175	1,336,109	88,085	1,899,159	138,600	4,111,128	2,227,564	.....	387,600	1,839,964	—6,300
Houston, East & West Texas	191	805,303	300,001	1,170,737	253,795	151,230	21,140	394,142	38,111	858,418	312,319	.....	36,072	276,247	—20,133
Houston & Texas Central	789	3,849,974	1,592,781	5,832,882	851,424	993,597	181,541	2,351,978	169,506	4,548,046	1,284,836	—11,065	193,351	1,080,400	432,147
Indiana Harbor Belt	105	.....	.....	2,699,344	311,629	319,605	25,428	1,191,357	68,225	1,916,244	783,100	17,386	55,554	744,932	158,422
Lake Erie & Western	906	4,020,643	740,523	5,040,329	719,681	929,526	119,194	1,934,860	116,817	3,820,078	1,220,251	.....	203,631	1,016,620	130,381
Lake Shore & Michigan Southern	1,872	32,720,734	10,351,952	48,403,719	5,746,503	8,457,253	828,483	15,700,884	845,144	31,578,267	16,825,452	102,464	1,531,098	15,396,818	1,438,213
Lehigh & Hudson River	97	1,418,054	40,062	1,513,715	181,379	222,175	13,283	548,516	44,683	1,010,035	503,679	.....	40,000	463,679	15,261
Louisiana & Arkansas	255	1,152,043	201,285	1,405,046	216,937	211,920	24,468	373,068	49,247	875,640	529,406	.....	41,902	487,504	100,195
Louisiana Ry. & Navigation	351	1,244,691	242,317	1,591,019	224,058	191,219	59,216	631,911	68,293	1,174,697	416,322	.....	51,000	365,322	—2,537
Louisiana Western	208	1,260,397	584,034	1,928,759	233,332	347,638	71,931	594,422	56,879	1,304,202	624,557	—650	75,842	548,065	155,875
Louisville, Henderson & St. Louis	200	645,863	307,922	1,024,177	265,815	137,314	43,747	391,971	30,799	869,646	154,531	2,231	30,000	126,762	—112,845
Michigan Central	1,817	19,254,767	7,177,028	29,378,856	3,452,076	4,288,657	662,423	11,753,769	518,192	20,675,117	8,703,739	16,890	1,134,985	7,585,644	236,905
Missouri, Kansas & Texas System	3,817	18,051,746	7,856,290	27,585,043	3,819,120	3,477,322	623,247	10,250,841	875,431	19,045,961	8,539,082	—48,083	1,078,530	7,412,469	2,392,591
Mobile & Ohio	1,114	8,303,342	1,224,228	10,121,981	1,195,586	1,885,122	378,947	3,646,585	321,273	7,427,513	2,694,468	—14,583	300,187	2,379,698	201,910
Morgan's La. & Tex. R. R. & S. S. Co.	404	2,728,994	960,784	3,930,338	715,161	615,921	131,886	1,881,287	118,494	3,262,749	667,589	—21,104	185,257	461,228	—468,011
Nashville, Chattanooga & St. Louis	1,231	7,772,269	2,567,654	11,111,544	1,696,501	1,973,163	395,964	4,271,278	292,761	8,629,667	2,481,877	—5,310	256,242	2,220,325	89,174
New Orleans, Mobile & Chicago	547	1,693,829	295,598	2,112,299	376,834	219,827	35,938	808,379	81,726	1,472,704	639,595	—915	54,648	584,032	111,589
New Orleans, Texas & Mexico	286	1,059,943	175,374	1,329,098	224,487	117,892	34,162	593,699	64,706	1,034,846	294,252	.....	19,162	275,090	77,212
New York Central & Hudson River	3,750	56,705,614	28,078,079	94,614,891	12,649,071	17,593,575	1,836,193	34,685,470	2,319,178	69,083,487	25,531,404	329,195	5,199,623	20,660,976	2,313,922
New York, Ontario & Western	566	6,069,521	1,398,491	7,843,420	991,096	1,272,569	108,551	2,897,762	165,573	5,435,551	2,407,869	—20,087	181,666	2,206,116	644,934
New York, Susquehanna & Western	154	1,684,690	473,578	2,446,469	261,399	303,696	20,079	1,033,305	49,519	1,667,998	778,471	—28,868	152,880	596,723	—152,570
Norfolk & Western	2,034	30,987,180	3,917,554	36,095,464	4,580,732	6,779,184	566,280	10,809,914	664,155	23,400,265	12,695,199	—21,980	1,208,000	11,465,219	1,035,232
Northern Pacific	6,314	44,299,039	12,932,809	60,885,499	8,026,446	7,021,530	1,054,292	19,815,390	870,133	36,787,791	24,097,708	278,913	3,305,638	21,070,983	2,152,753
Pecos & Northern Texas	482	1,585,707	415,278	2,136,842	256,604	420,710	37,204	688,681	65,312	1,468,511	668,331	.....	51,560	616,771	208,148
Peoria & Eastern	352	2,204,103	594,110	2,984,833	421,694	593,875	46,194	1,164,875	57,704	2,284,342	700,491	.....	110,348	590,143	—16,374
Philadelphia & Reading	1,015	34,388,368	5,810,070	42,290,006	3,727,249	7,031,933	410,596	13,590,119	613,005	25,372,902	16,917,104	308,274	863,252	16,362,126	3,143,417
Pittsburgh & Lake Erie	223	14,396,043	1,428,979	16,420,031	1,602,282	2,466,349	135,091	3,697,812	267,570	8,169,104	8,250,927	—4,108	369,589	7,877,230	2,018,097
Pittsburgh, Shawmut & Northern	279	1,550,065	93,323	1,669,714	272,160	365,963	11,671	534,423	40,486	1,224,703	445,011	.....	15,912	429,099	42,498

REVENUES AND EXPENSES OF RAILWAYS.

TEN MONTHS OF FISCAL YEAR, 1913—(CONTINUED).

Name of road.	Average mileage operated during period.	Operating revenues — Freight.	Operating revenues — Passenger.	Operating revenues — Total, inc. misc.	Operating expenses — Maintenance — Way and structures.	Operating expenses — Maintenance — Of equipment.	Operating expenses — Traffic.	Operating expenses — Trans-portation.	Operating expenses — General.	Operating expenses — Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Port Reading	21	1,312,976	....	1,343,881	104,514	3,172	303	358,393	1,445	467,827	876,054	65,805	80,000	861,859	175,295
Richmond, Fredericksburg & Potomac	88	1,264,665	866,140	2,427,976	251,032	271,608	29,748	866,340	68,131	1,486,859	941,117	—2,299	7,353	931,465	234,172
St. Louis & San Francisco	4,742	24,775,210	9,110,546	36,358,833	4,320,814	4,751,156	791,005	12,958,753	1,013,694	23,835,422	12,523,411	....	1,679,484	10,843,927	1,423,029
St. Louis Merchants' Bridge Terminal	9	....	3,678	1,763,275	304,398	100,529	6,973	907,880	61,387	1,381,167	382,108	....	58,050	324,058	103,177
St. Louis, San Francisco & Texas	244	931,589	294,946	1,307,583	216,440	161,539	25,576	574,108	55,706	1,033,369	274,214	....	10,888	263,326	83,377
St. Louis Southwestern	906	5,589,968	1,271,551	7,252,496	765,936	1,013,528	293,238	1,725,739	260,674	4,059,115	3,193,381	—8,054	262,416	2,922,911	581,452
San Pedro, Los Angeles & Salt Lake	1,135	5,231,922	2,605,953	8,436,598	928,220	1,456,299	311,282	2,744,990	190,346	5,631,137	2,805,461	—16,083	349,797	2,439,581	1,517,519
Southern	7,037	38,106,862	15,198,515	57,776,683	7,649,601	9,441,526	1,728,277	19,714,232	1,671,961	40,205,597	17,571,086	67,095	2,073,825	15,564,356	510,084
Southern in Mississippi	281	571,363	305,446	951,654	277,152	89,409	23,999	427,544	41,444	859,548	92,106	....	73,102	19,004	—114,054
Southern Kansas of Texas	125	1,059,549	181,685	1,288,768	97,605	267,555	22,543	388,323	36,509	812,535	476,233	....	21,513	454,720	220,406
Southern Pacific Co.	6,329	47,272,435	26,644,641	79,471,533	8,554,202	10,953,180	1,717,930	22,300,059	2,157,910	45,683,281	33,788,252	1,361,990	3,687,433	31,462,809	2,469,746
Spokane, Portland & Seattle	556	2,705,161	1,375,100	4,433,743	534,636	394,007	74,966	1,089,328	127,572	2,220,509	2,213,234	1,332	534,000	1,680,566	94,680
Terminal R. R. Ass'n of St. Louis	34	....	2,845	2,508,070	385,159	184,808	9,232	942,881	66,021	1,588,101	919,969	104,600	268,765	755,804	167,141
Texas & New Orleans	458	2,333,261	981,848	3,540,883	739,399	753,007	82,346	1,389,374	121,342	3,085,468	455,415	2,539	128,634	329,320	23,444
Texas & Pacific	1,885	10,726,644	3,805,454	15,509,339	1,936,096	2,473,350	340,188	7,104,196	459,470	12,313,300	3,196,039	—20,053	542,621	2,633,365	—480,273
Toledo & Ohio Central	443	3,745,259	528,491	4,512,675	674,435	853,894	69,884	1,603,773	91,309	3,293,295	1,219,380	—7,274	214,210	997,896	46,980
Trinity & Brazos Valley	463	1,961,660	484,449	2,546,217	443,396	347,716	102,006	1,203,848	122,227	2,219,193	327,024	....	39,513	287,511	3,680
Virginia & Southwestern	240	1,311,529	144,866	1,495,473	227,340	344,182	19,321	412,441	34,917	1,038,201	457,272	....	58,796	398,476	—53,101
Wabash	2,515	18,256,210	6,002,107	26,558,117	3,375,405	4,432,239	842,016	11,130,288	654,646	20,434,594	6,123,523	—41,926	748,997	5,332,600	1,202,373
Washington Southern	36	385,527	425,632	1,090,860	134,657	131,758	12,272	425,227	28,677	732,591	358,269	—2,127	33,984	322,158	33,797
Western Maryland	543	5,178,816	808,459	6,277,713	901,881	881,831	156,010	2,716,414	135,085	4,791,221	1,486,492	....	200,000	1,286,492	—625,780
Western Pacific	937	3,888,009	1,095,981	5,136,835	771,864	444,088	292,158	1,997,059	253,449	3,758,618	1,378,217	—9,149	225,778	1,143,290	528,034
Western Ry. of Alabama	133	644,140	458,974	1,199,020	197,781	219,146	59,123	335,322	57,103	868,475	330,545	116	48,356	282,305	9,371

— Indicates Deficits, Losses and Decreases.

Railway Officers.

Operating Officers.

C. W. McCoppin has been appointed general manager of the Riviera Beach & Western, with headquarters at Riviera, Texas.

W. F. Sheridan has been appointed assistant superintendent of transportation of the Louisville & Nashville, with office at Louisville, Ky.

J. R. Jones has been appointed trainmaster of the International & Great Northern at San Antonio, Tex., succeeding J. L. Otis, assigned to other duties.

H. H. Smith, heretofore chief clerk to general manager of the Canadian Northern, Quebec, has been appointed car service agent of the same company, with office at Montreal.

J. J. Rhoads, hitherto division engineer of the middle division of the Pennsylvania, has been appointed superintendent of the central division of the Philadelphia, Baltimore & Washington, with office at Media, Pa.

George R. Sinnickson, hitherto division engineer of the West Jersey & Schuylkill and the Pennsylvania at Camden, N. J., has been appointed superintendent of the Schuylkill division of the Pennsylvania, with office at Reading, Pa.

N. W. Smith, heretofore division superintendent of the Philadelphia, Baltimore & Washington at Media, Pa., has been appointed superintendent of the middle division of the Pennsylvania, with office at Altoona, Pa., succeeding C. A. Preston.

James Fitzsimons, heretofore general eastern freight agent of the Delaware & Hudson, at Albany, has been appointed general manager of the Quebec, Montreal & Southern, with office at Montreal, Que. The Q. M. & S. is a subsidiary of the D. & H.

L. E. Abbott has been appointed safety commissioner of the Oregon Short Line, with headquarters at Salt Lake City, Utah. He will be in general charge, under immediate direction of the Central Safety Committee, of all matters pertaining to the "Safety First" movement of that road.

W. R. Scott, general manager of the Southern Pacific, announces that Paul Shoup will assume charge of the operation of the Oakland, Alameda and Berkeley suburban lines. The ferry boats and piers will be operated by the Western division, as at present. Effective June 8.

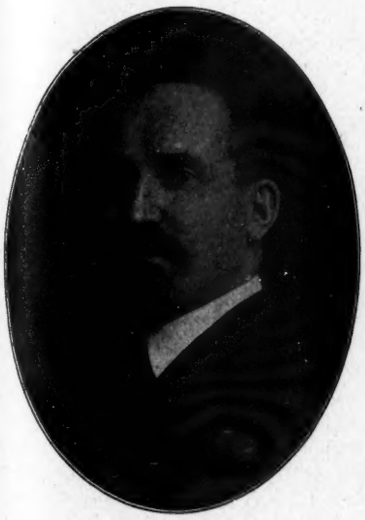
Joseph James Rhoads, whose appointment to the position of superintendent of the Central division of the Philadelphia, Baltimore & Washington, is noted above, has been in the service of the Pennsylvania Railroad and its controlled lines since March 1, 1899, when he entered the engineering department as rodman. He was born at Bellefonte, Pa., August 23, 1868, and was educated at Swarthmore College, whence he was graduated in the class of 1888 in the engineering department. His first railway service was on the Pittsburgh, Monongahela and Philadelphia divisions of the Pennsylvania. In June, 1892, he entered the office of the engineer of maintenance of way, at Altoona; January 15, 1893, he was appointed assistant supervisor on the Amboy division, at Jamesburg, N. J.; was transferred to the Maryland division of the P. B. & W. as assistant supervisor, at Washington, D. C., December 1, 1897; and 16 months later went back to New Jersey as supervisor on the Amboy division, at

J. J. Rhoads.

Jamesburg. He was appointed supervisor on the New York division, at Tacony, Pa., March 1, 1901; assistant engineer of the Williamsport division, at Williamsport, July 1, 1905; division engineer of the Philadelphia Terminal division, West Philadelphia, April 1, 1907, and division engineer of the Middle division, at Altoona, January 15, 1910. This position he held up to the present month.

C. H. Marshall, formerly division superintendent of the Chicago, Milwaukee & St. Paul, at Missoula, Mont., and more recently superintendent of construction of the Chicago & Council Bluffs division, with headquarters at Marion, Iowa, has been appointed division superintendent, with headquarters at Perry, Iowa.

J. B. Carothers, who has been appointed assistant to the general superintendent of the Baltimore & Ohio Southwestern and the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio, was born on February 26, 1863, at Cutler, Washington county, Ind. He was educated at a normal university and began railway work in 1888, as a rodman in a surveying party. From 1889 to 1891, he was with the Seattle, Lake Shore & Eastern, and its successor, the Northern Pacific, as transitman, and was then for four years out of railway service. In June, 1895, he was appointed assistant engineer on the Baltimore & Ohio Southwestern at Cincinnati; a year later he was made division engineer on the Springfield division, at Flora, Ill., where he remained until April, 1902 except for a year, when he was out of service on leave of absence. He was later division engineer on the Ohio division, and also on the Indiana division. In February, 1904, he was made superintendent of the Ohio division at Chillicothe, Ohio, and in November of the following year, became superintendent of the Illinois division, with office at Washington, Ind. In April, 1910, he was appointed chief engineer of maintenance of way at Cincinnati, Ohio, and was then consecutively superintendent of the Philadelphia division of the Baltimore & Ohio at Philadelphia, Pa., and engaged in a special engineering capacity on the staff of the chief engineer.



J. B. Carothers.

George P. Johnson, for the past year receiver of the Detroit, Toledo & Ironton, has been appointed general manager of the Chesapeake & Ohio, with office at Richmond, Va., the appointment to take effect July 1. This office has been vacant since about one year ago when E. W. Grice, general manager, was appointed to the position of assistant to the vice-president in charge of operation. Mr. Johnson is 39 years old and is the son of President L. E. Johnson, of the Norfolk & Western. He was born at Aurora, Ill., where his father was an officer of the Burlington road. He began his railroad service on the Burlington as a clerk, January 1, 1890. He held this position only a few months, however, and then started to make himself an all around railroad man by working as brakeman, freight conductor, yard master, station master and in other positions, on the Burlington, the Great Northern and the Lake Shore & Michigan Southern, until July 1, 1898, when he was appointed general yardmaster of the Norfolk & Western, at Kenova, W. Va. A year later he was promoted to the position of trainmaster at Lynchburg, and in October, 1902, he was made superintendent of the Shenandoah division, at Roanoke. In 1904 he was sent to the Scioto division, and on July 1, 1907, was appointed general superintendent of the Western general division, with office at Bluefield, W. Va. In May of last year he resigned this position to take the management of the Detroit, Toledo & Ironton, as above noted.

Cecil Anthony Preston, whose appointment as valuation engineer of the Pennsylvania Railroad is noted above, has been superintendent of the Middle division of that road for the past ten years. He was born in Philadelphia and was graduated from the Polytechnic College of Philadelphia in 1872, as civil engineer. He at once entered actively into railroad construction work, but he did not enter the service of the Pennsylvania until 1879. In 1878 he was associated with the Collins Expedition in the construction of the Madeira & Mamore, in Brazil, where he served as engineer. His first service for the Pennsylvania was in connection with surveys for new lines. On March 1, 1880, he was appointed assistant supervisor of the Baltimore section of the Northern Central; but after a few months he resigned and went to Mexico, where he was engaged as principal assistant engineer of the Mexican National Construction Company. He returned to the United States in 1882 and again entered the service of the Pennsylvania (Northern Central), being appointed assistant supervisor at York, Pa. He was promoted to different positions (in 1882, 1890 and 1893) until, in July, 1900, he was made superintendent of the Elmira and Canandaigua divisions of the Northern Central, with office at Elmira, N. Y. Two years later he went to Williamsport as superintendent of the Eastern and Susquehanna divisions, and in the next year, 1903, was appointed superintendent of the Middle division of the Pennsylvania at Altoona, as above noted, the duties of which position he has now been relieved from.

C. A. Preston.

Traffic Officers.

R. O. Von Steuben has been appointed commercial agent of the New York Central, and all of its controlled lines, at Newark, N. J.

W. E. Taylor has been appointed commercial agent of the Chicago, Rock Island & Pacific, at Lincoln, Neb.; in place of E. O. Miller, deceased.

C. S. Blackman has been appointed general agent of the Missouri Pacific and St. Louis, Iron Mountain & Southern, at Hot Springs, Ark.

John J. Coyle, heretofore general southern agent of the Delaware & Hudson, at Philadelphia, has been appointed general eastern freight agent of the same company, at Albany, succeeding James Fitzsimons, promoted.

W. M. Hughes has been appointed traveling passenger agent of the Chicago, Burlington & Quincy, with headquarters at St. Paul, Minn., to succeed W. H. Snyder, who has been appointed city passenger agent at St. Paul.

A. M. Reinhardt has been appointed assistant general freight agent of the Atchison, Topeka & Santa Fe Coast Lines, with headquarters at Los Angeles, Cal. F. A. Bell has been appointed general agent at San Francisco, Cal.

J. M. Ball, division freight agent of the International & Great Northern at San Antonio, Tex., has been appointed cotton agent. He is succeeded as division freight agent by J. W. King, heretofore traveling freight agent for the St. Louis, Iron Mountain & Southern.

H. M. Mayo, assistant to the president of the Sunset-Central Lines of the Southern Pacific, has been appointed manager of the industrial, immigration and advertising bureau, with headquarters at Houston, Tex. This is a new department to be established by the Sunset Central Lines of Texas and Louisiana on July 1.

George T. Bell, whose appointment as traffic manager of the Grand Trunk Pacific has been announced in these columns, was born at Montreal, September 7, 1861. He entered the railway service at the age of 17 as a clerk in the car mileage office of the Great Western Railway of Canada, now part of the Grand Trunk. He was soon transferred to the passenger department, and held various positions in that department until April, 1892, when he was appointed assistant general passenger agent of the Grand Trunk. Four years later he was made assistant general passenger and ticket agent, and in 1899 was promoted to a higher position at Chicago. In May, 1900, he was made general passenger and ticket agent, with headquarters at Montreal, which position he held until May 1, 1909, being also during the latter part of this time general passenger agent of the Grand Trunk Pacific; and for the last two years he has been assistant passenger traffic manager.

George T. Bell.

Engineering and Rolling Stock Officers.

Thomas B. Kennedy has been appointed engineer of the Cumberland Valley in place of George C. Koons, resigned, to go to the Pennsylvania.

The headquarters of B. B. Shaw, assistant engineer of the Chicago, Rock Island & Pacific, have been moved from El Reno to McAlester, Okla.

George C. Koons, hitherto engineer of the Cumberland Valley, has been appointed assistant engineer of maintenance of way of the Pennsylvania, in charge of bridges and structures, with office at Philadelphia.

C. A. Preston has been appointed valuation engineer of the Pennsylvania Railroad. Mr. Preston hitherto has been superintendent of the middle division at Altoona, in which position he is succeeded by M. W. Smith.

C. I. Leiper, hitherto division engineer of the New York division of the Pennsylvania Railroad, has been appointed principal assistant engineer of the Philadelphia, Baltimore & Washington, with office at Wilmington, Del.

F. S. Schorndorfer, general foreman of shops of the Cincinnati, Hamilton & Dayton, at Ivorydale, Ohio, has been appointed general foreman of shops of the Baltimore & Ohio Southwestern, at Chillicothe, Ohio, in place of J. G. Hyson, resigned.

Joseph T. Richards, chief engineer of maintenance of way of the Pennsylvania Railroad, Philadelphia, has been appointed consulting engineer of maintenance of way. L. R. Zollinger, engineer of maintenance of way, retains his present title.

A. B. Clark, hitherto assistant engineer of the Philadelphia, Baltimore & Washington, at Wilmington, Del., has been appointed assistant engineer of maintenance of way of the Pennsylvania, in charge of roadway and track, with office at Philadelphia.

E. D. Sabine has been appointed terminal engineer, at the Grand Central Terminal, New York City (N. Y. C. & H. R.), in place of W. L. Morse, who has gone to Florida, as noted below. Mr. Sabine has served in the engineering department at the Grand Central for several years past.

M. K. Barnum, heretofore general superintendent of motive power of the Illinois Central, has been appointed general mechanical inspector of the Baltimore & Ohio, the appointment to take effect July 1. A portrait of Mr. Barnum, with a sketch of his life, appeared in this paper May 23.

President Geo. W. Stevens, of the Chesapeake & Ohio, announces the appointment of a valuation committee, to devote its entire time to valuation work, the members of which are F. I. Cabell, chief engineer, chairman; J. P. Nelson, real estate; E. M. Thomas, accountant. These men are relieved of all duties in connection with their own departments. W. F. Steffens, assistant chief engineer, will perform the duties of chief engineer.

W. L. Morse, heretofore an engineer on the Grand Central Terminal improvement, New York City, has been appointed chief engineer of the Jacksonville Terminal Company, Jacksonville, Fla. Mr. Morse was graduated from Boston University in 1895 and began railroad work in 1896 in the surveying corps of the New York, New Haven & Hartford. He has been with the New York Central at Grand Central Terminal, New York City, since 1902, having been appointed resident engineer in 1906.

The Pennsylvania announces six appointments in the engineering department as follows: H. H. Russell, heretofore engineer of the Allegheny division, has been appointed engineer of the Middle division, with office at Altoona, Pa.; the appointment to take effect June 16. D. T. Easby, heretofore supervisor on the Middle division, has been appointed division engineer of the Allegheny division, with office at Oil City, Pa. F. W. Smith, Jr., heretofore engineer of the Conemaugh division, has been appointed engineer of the New York division, with office at Jersey City, N. J. C. E. Zortman, heretofore supervisor on the Pittsburgh division, has been appointed engineer of the Conemaugh division, with office at Pittsburgh, Pa. C. E. Brinser, heretofore on the New York, Philadelphia & Norfolk, has been made division engineer of the West Jersey & Sea Shore, at Camden, N. J. T. J. Skillman, heretofore on the Pennsylvania road at New York City, has been appointed division engineer of the New York, Philadelphia & Norfolk, with office at Cape Charles, Va.

Julius E. Willoughby, whose appointment as assistant chief engineer of the Atlantic Coast Line has been announced in these columns, was born at Arkadelphia, Ala., October 12, 1871, and was educated at the University of Alabama, from which institution he was graduated in 1892 as Bachelor of Civil Engineering. He had done some work on railway surveys when in college, and his first regular service was with the Louisville & Nashville, where he was engaged on surveys and new construction from 1892 to 1900. In April, 1900, he was appointed assistant chief engineer of construction of new lines, and the following year was made engineer of construction of the Alabama & Florida, a subsidiary of the L. & N. He was engaged in other similar positions until 1905, when he was appointed engineer of construction, which position he held until March, 1912. During this time he was chief engineer on a number of subsidiary lines. In 1912 he was chief engineer of the Caribbean Construction Company and of the National Railroad Company of Haiti, which position he held until the present month. He is a member of the American Society of Civil Engineers and of the American Railway Engineering Association.

OBITUARY.

John Heimrich, president of the Great Southern, died at his home in Portland, Ore., on June 11, aged 67 years.

William K. McAllister, general agent of the Southern Pacific at Denver, Colo., died in that city on June 12, aged 63 years. Mr. McAllister had been connected with the Southern Pacific since 1893, and was made general agent in March, 1895.

GEORGE-OUDTSHOORN RAILWAY, SOUTH AFRICA.—The very important George-Oudtshoorn line has now been linked up at Doorn river. The line was commenced in 1908, and it is estimated that the cost will be something like $1,850,000. It will probably be open for traffic this month. After leaving George, the line winds in and out of the gorges of the Outeniqua range, passing through seven tunnels and climbing 1,600 ft. It then descends 1,300 ft. before reaching Oudtshoorn. From the tourist point of view, climbing along a precipitous mountain side and presenting a magnificent panorama of mountain, sea and plain, the line bids fair to be one of the show lines of a system that includes many stretches of very wonderful scenery.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

THE GRAND TRUNK has ordered 25 locomotives from the Baldwin Locomotive Works.

THE SIOUX CITY TERMINAL RAILWAY has ordered from the American Locomotive Company 1 six-wheel switching locomotive weighing 117,000 lbs. The cylinders are 19 x 24, and the driving wheels 50 in.

CAR BUILDING.

THE INTERCOLONIAL has ordered 500 steel underframe box cars from the Nova Scotia Car Works.

IRON AND STEEL.

GENERAL CONDITIONS IN STEEL.—New business is coming in at the rate of about 60 per cent. of shipments. Consumers are not making any objection to receiving deliveries, and manufacturers are more aggressive in their bidding for new business. The tariff situation still is used by consumers as an argument for waiting to place orders, and German steel conditions, which are demoralized, possibly have a bearing on the steel market in this country.

SIGNALING.

The Central of New Jersey has ordered from the Union Switch & Signal Company automatic block signals for its line between Red Bank, N. J., and Lakehurst, N. J., 28 miles of single track.

The seven mile line of the Butte, Anaconda & Pacific at the Anaconda Mines, Montana, recently electrified, is to be equipped with alternating current automatic block signals, the contract having been given to the Union Switch & Signal Company. The propulsion current is 2400 volts d. c. The track circuit has double rail return, and alternating current is used for everything including switch indicators and track circuits. Current will be distributed at 2080 volts, single phase, 60 cycles. The signals are semaphores, one arm, style B, moving in the upper left hand quadrant, similar to those which have been put up by the Union Company on the lines of the Illinois Traction Company.

The Canadian Pacific is to install five interlocking plants in Western Canada as follows, the contracts having been given to the Union Switch & Signal Company, Swissvale, Pa. Calgary, tower No. 1, mechanical interlocking with a 48 lever machine. At tower No. 2, Calgary, a 60 lever machine. At Whittier Junction on the Manitoba division electric interlocking, type F, 28 working levers in a 41-lever frame. The signals will be style T-2 top post. This interlocking will control the draw bridge over the Red river. At North Transcona at the crossing of the Canadian Northern a 64-lever mechanical interlocking, Saxby & Farmer machine. At Transcona a 36-lever mechanical interlocking, with electric distant signals, style T-2. The Canadian Pacific has also contracted with the Union Company for the installation of automatic block signals on the seven miles of double track east and west of Calgary. These signals will be style T-2, three-position. There will be eighteen switch indicators.

OPENING OF THE LOTSCHBERG RAILWAY, SWITZERLAND.—The new Bernese Alps Railway, Berne-Lötschberg-Simplon, will be opened this month to traffic. This event will denote the deviation of a large proportion of Swiss railway traffic into new channels and the opening of a new important approach to Italy. The completion of this railway crowns the railway policy which has been followed by the canton of Berne during the last 50 years. It realizes the idea of a passage through or over the Bernese Alps which has been attempted again and again since the Middle Ages, and so solves an ancient traffic problem. Berne, besides taking a leading part in the construction of the new railway, has lately steadily worked for a consolidation of the several subsidized Berne railways.

Supply Trade News.

William C. Jones, Ltd., Boston, Mass., with head office in Manchester, England, have completed a new patented demonstration plant at Boston, Mass., for the manufacture of wiping waste in rope form, known as Boa waste. It is understood that the company has put up this plant for demonstration purposes only and does not intend to itself go into the manufacture of wiping waste in this country.

TRADE PUBLICATIONS.

STEAM COUPLERS.—The Gold Car Heating & Lighting Company, New York, has just issued an illustrated description of the Gold wedge lock steam coupler, together with a comparative diagram showing the action of the Gold steam couplers oscillating gasket and the non-oscillating soft gasket.

THE DENVER & RIO GRANDE.—The passenger department has just issued several little booklets of interest to tourists—one containing a list of hotels and ranch boarding houses, giving also specific information regarding rates, post office address, distance from railroad station, etc., and another devoted to Yellowstone Park.

A COMBINATION STEEL TIE AND TIE BAR.—A pamphlet has been published by J. F. Donahoo, Birmingham, Ala., describing the International Safety Railway Tie, which consists of a steel casing carrying two wooden blocks upon which the rail rests. The rail is held in position by special steel tie bars and bolts through the tie, eliminating the use of spikes.

COPPER RIVER & NORTHWESTERN.—This company has just issued a rather attractive little leaflet describing some of the Alaska country traversed by the Copper river route, which runs from Cordova to Kennecott, 196 miles. With this leaflet is being distributed a folder of the Alaska Steamship Company, giving information as to steamship routes to Alaska and along the coast.

COMPARATIVE STATISTICS.—Thompson, Towle & Company, New York, have prepared and are distributing to their customers a table showing "Essential Statistics on Important Railroads," covering results of operation for the year ended June 30, 1912, The table shows capitalization, dividend rate, fixed charges, net earnings, etc., and certain per mile of road figures, with the dividend record for six years, and high and low stock quotations for six years for about 55 roads.

RAILWAY DIFFICULTIES IN ARGENTINA.—Notwithstanding the remarkable progress which is manifested year by year by the great majority of Argentine railways, some of the troubles from which they have suffered, almost from the beginning of their successful career, have still to be faced. Among these difficulties may be included the native jealousy which exists in regard to foreign enterprises and which it would appear is most difficult to overcome. This jealousy manifests itsself in particular in the relations existing between the companies and the municipalities; so acute is this at times that several important improvements had to be abandoned, and as a consequence the public suffers and the companies sustain financial losses. A case in point is the dispute which of late has raged between the Central Argentine Railway and the Cordoba municipality. It had been the wish of the company to erect a handsome station in the city of Cordoba. From the commencement, however, the company has met with scant consideration from the municipality; on the contrary, a spirit of opposition has been displayed even in regard to the most simple matters. At length the patience of the company has been exhausted and the board of directors in London, acting upon information sent to them from Cordoba, have telegraphed instructions to their local representatives in Cordoba, to suspend all work upon the new station building, to sell the materials already received and to dismiss all the workmen employed. The directors' action was precipitated by the persistent and unreasoning difficulties placed in the way of progress by the municipality, especially in regard to the matter of approaches to the new station building. While the interests of the company are bound to suffer by this drastic decision, those of the traveling public will be more seriously affected still.

Railway Construction.

Columbia & Nehalem.—An officer writes that work is now going on, principally by the company's own forces, on this line which is being built from Ross Landing, south 30 miles. Contracts for part of this work would be let to outside contractors, if favorable bids could be obtained, the officer says. For the first 15 miles the work is quite heavy, and for the balance comparatively light. There will be one 225 ft. Howe truss bridge and one 1,300 ft. tunnel. A. S. Kerry, 716 Spaulding avenue, Portland, Ore., president, and G. A. Kyle, Portland, Ore., chief engineer.

Hiawassee Valley Railway.—An officer writes that contracts will be let for grading, etc., on this road about July 15. The road is projecting from Andrews, N. C., on the Southern Railway via Marble, Peach Tree and Hayesville to Hiawassee. The work will not be difficult and the standard adopted has been a 2 per cent. grade and 10 deg. curves. J. Q. Barker, president, and W. C. Sanderlin, chief engineer, Andrews, North Carolina.

Huntsville, Moberly & Randolph Springs.—An officer writes that the Jennings Construction Company, of Joplin, Mo., has been given the contract for grading this electric road from Randolph Springs to Moberly, Mo., and that Edward Freed, of Moberly, Mo., has been given the contract for the concrete work.

Kansas City, Kaw Valley & Western.—An officer writes that contracts will be let for grading about July 1 for this road which is projecting from Kansas City via Muncie, Kan., Edwardsville, Bonners Springs, Lanape, Loring and Linwood to Lawrence. About three miles of track have been laid. The work is fairly easy except on one three-mile section. One and one-half per cent. grades and 70 deg. curves have been adopted as standard. There will be a steel bridge about 1,000 ft. long across the Kaw River. J. D. Waters, president, and O. W. Williamson, chief engineer, Bonners Springs, Kansas.

Salt Lake & Utah.—An officer writes that this road is being built in two sections, the first running from Salt Lake City, Utah, via Taylorsville, West Jordan, Riverton, Lehi, American Fork and Pleasant Grove to Provo, Utah, about 24 miles. The second section is projected from Provo via Spanish Fork and Springville to Payson, Utah, between 18 and 20 miles. Contracts are now being let for the grading from Provo to a point between Lehi and West Jordan. Two miles of track has been laid in Salt Lake City, and about two miles each in Provo and American Fork. This work has been done by the Inter-Urban Construction Company, which has been incorporated to build and equip the roads. Contracts for steel construction will be let in the near future. The road is to be operated by electricity as an interurban passenger and freight road. It is expected that freight will consist largely of farm products and supplies for farmers. The orders for rolling stock have already been largely placed. W. C. Orem, Newhouse building, Salt Lake City, Utah, is president, director and general manager; Jas. G. Berryhill, Des Moines, Iowa, is vice-president and a director.

Temple, Northwestern & Gulf.—An officer writes that 3.3 miles of track have been laid and the company expects to immediately build a line from Temple northwest to Gatesville and Dublin, Tex., 100 miles. The company's own construction company is the general contractor. The work to be done in the near future consists of track laying, and in about 90 days two steel bridges of about 150 ft. each are to be begun. There is one rock cut to be excavated about a mile and a half long, and from 3 to 7 ft. deep. J. F. Sadler, president, Houston, Tex.; W. E. Dozier, chief engineer, Temple, Tex.; W. A. McGregor, vice-president and general manager, Temple, Tex.

RAILWAY STRUCTURES.

Bonners Springs.—See Kansas, Kaw Valley & Western under Construction.

Temple, Tex.—Gulf, Colorado & Santa Fe. This company asked for bids on June 9 on a $25,000 six-stall engine house.

Topeka, Kan.—The Atchison, Topeka & Santa Fe has begun work on an addition to its shops to cost about $20,000.

Railway Financial News

Baltimore & Ohio.—The $20,000,000 1-year 5 per cent. secured notes, which were bought from the railroad company by Kuhn, Loeb & Company, and Speyer & Company, both of New York, are being offered to the public at 99¼. The notes are dated July 1, 1913, and are secured by the deposit of $29,000,000 Baltimore & Ohio Chicago Terminal first mortgage 4 per cent. bonds, due April 1, 1960.

John F. Stevens, at the request of President Williard, has made an inspection of the Baltimore & Ohio. In commenting on this inspection, he said in part: "The road's gross earnings this year will be about $100,000,000. I haven't a doubt that in ten years it will be earning fully $150,000,000. The only difficulty will be to furnish facilities and to avoid congestion. That is a matter of raising the capital, and I hold that the Baltimore & Ohio will be able to find the money, if any railroad will. Baltimore & Ohio flood damage, with the exception of bridges, has been substantially made good. Baltimore & Ohio construction work is a good deal like that of the continental European roads, done to last for all time."

Chicago & Western Indiana.—W. J. Jackson, president of the Chicago & Eastern Illinois, has been elected a director of the Chicago & Western Indiana, succeeding B. L. Winchell, resigned.

Kansas City, Mexico & Orient.—Application for a final decree to permit a foreclosure sale has been made to Judge Pollack in the United States District Court by the United States & Mexican Trust Company. The new company has been in process of organization for several weeks.

Missouri, Kansas & Texas.—Frank Trumbull, chairman of the board, after an inspection trip, said in part: "This company will earn between 2½ and 3 per cent. on its common stock for the year ending June 30. The road was never in better physical condition. In the southwest, through Kansas, Oklahoma and Texas, the crop prospects are excellent, and bankers through the territory told me that they looked for a big business in the fall. One of the most encouraging features of my trip was the evidence of a more friendly spirit toward railroads in the west and southwest."

Pennsylvania Railroad.—See editorial comments in regard to the exchange of Baltimore & Ohio stock for Southern Pacific stock.

Pittsburgh, Youngstown & Ashtabula.—The Public Service Commission of Ohio has authorized the company to issue $640,000 series A first general mortgage, 4 per cent. bonds of 1908-1948 at not less than par, the money to be used to reimburse the Pennsylvania Company for advances for additions and betterments amounting to $640,296.

San Pedro, Los Angeles & Salt Lake.—This company has recently applied to the Railroad Commission of California for authority to issue $1,119,000 of bonds, the proceeds to be expended for new equipment, extensions and improvements.

San Pedro, Los Angeles & Salt Lake.—The company has asked permission of the California Railroad Commission to issue $1,119,000 bonds, to pay for new equipment and for the carrying out of certain betterment work, including grade reduction and construction of branch lines.

Southern Pacific.—This company has authorized an issue of $30,000,000 1-year 5 per cent. notes, of which $20,000 are to be underwritten by the syndicate headed by Kuhn, Loeb & Company, New York, who expect to offer them to the public at 99. The notes will be dated June 16, 1913, and are to be secured by the deposit of $17,500,000 Northwestern Pacific first and refunding mortgage 4½ per cent. bonds, due 1957; $17,500,000 Pacific Electric Railway refunding mortgage series A, 5 per cent. bonds, due 1961, and $4,000,000 Galveston, Harrisburg & San Antonio, Galveston-Victoria division, first mortgage 6 per cent. bonds, due 1940.

Union Pacific.—See editorial comments in regard to the exchange of Southern Pacific stock for Baltimore & Ohio stock.